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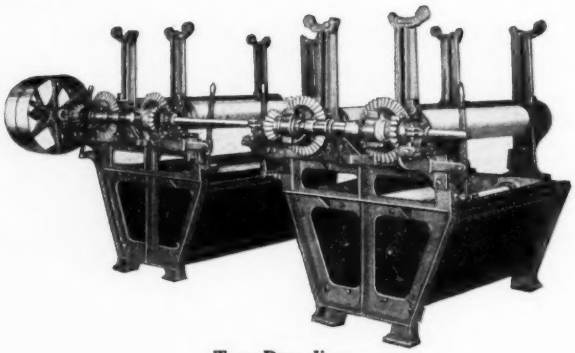

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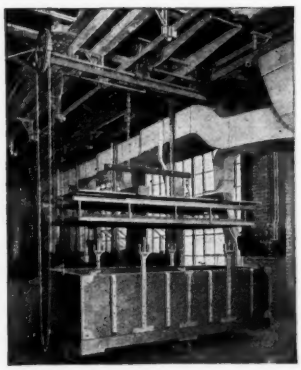

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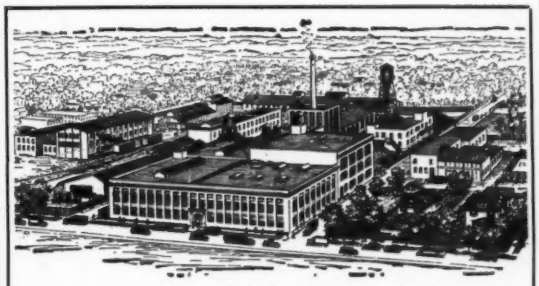

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VOLUME XV NEW YORK, AUGUST 9, 1926 No. 13

The Amino and Carboxylic Groups and Sulphur in Wool

A Consideration of the Various Reactions Indicating the Presence of the Amino and Carboxylic Acid Groups in Proteins, and the Character and Quantity of Sulphur in Wool.

By CHAS. E. MULLIN, M.Sc., F.A.I.C.

Consulting Chemist, Camden, N. J.

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AT various times many authors have questioned the presence of primary amino groups, as such in proteins and particularly in wool. A study of the recent literature upon the constitution of wool indicates that the presence of these groups, as well as free carboxylic groups, is much more widely accepted than formerly. When we consider the number and variety of amino acids present in the so-called wool molecule, and the high molecular weight of the proteins, it is possibly a little easier to imagine a few of these amino and carboxylic groups sticking out here and there, comparatively free, as it is to imagine each and every one of them to be rigidly united with its equivalent. Certainly their presence, or that of closely allied acid and basic groups in the wool fiber is necessary in any chemical theory of dyeing. The fact that both wool and silk may be diazotized and coupled with the usual components, such as naphthols and phenols, certainly goes a long way to indicate the presence of such groups. This diazotization of wool and silk is a very interesting, and apparently somewhat neglected field of study. It will therefore be discussed more fully in a separate paper.

The amino acid theory of protein constitution is almost, if not quite, the universally accepted theory of protein constitution. Table No. III* gives a list of the amino acids which have been found in the various proteins. Of course, there are other constituents present also which with our present limited knowledge we are unable to isolate and classify, but in a molecule as large and complex as the usual protein molecule (or perhaps aggregate is more correct) there are certainly some free amino and carboxyl groups. Very possibly the number of these free groups in the molecule varies with the state or condition of the protein. Undoubtedly one of the widely varying conditions which affects this equilibrium of the protein is the hydrogen ion concentration of the surrounding medium, as for instance the dye bath, or other processing liquor.

The presence of free amino groups in wool was for years the subject of much discussion among textile chemists and now that most of them agree that amino groups are present, some regard their position in the molecule as doubtful, while many more think that they play no part in dyeing and other processes. Considerable research has been done at various times upon the constitution of wool, and most of this has centered upon the presence, positions and reactions of the amino groups.

In writing upon the "Chemical Constitution of Wool," P. Richards, *Bull. Soc. Ind. Mulhouse,* September, 1888, stated that it was even then generally admitted that wool acted like an amino acid, especially in regard to its reactions with dyestuffs. Toward the basic dyes both wool and silk have acid properties, while with acid dyes they exhibit basic properties. R. appears to be the first to report upon the diazotization experiments mentioned in a previous paragraph, and coupled both wool and silk with phenol, resorcinol, pyrogallol, *a*-naphthol and *B*-naphthol.

Bentz and Farrell, *J. Soc. Chem. Ind. 16,* 405-6 (1897), confirmed Richard's work and state that diazotized wool and silk behave in all respects as diazo compounds, combining with phenols and amino bases, undergoing the general reactions for this class of substances observed by Griess and Sandmeyer, etc. Also that the wool and silk azo compounds are decomposed when heated with an

*American Dyestuff Reporter, June 28, page 416.

acidified solution of stannous chloride, the regenerated wool and silk being capable of being again diazotized and coupled with phenols and amino compounds. The quantity of diazotizable nitrogen present in wool appears to be only 1.0 or 1.2 per cent, that is, a fifteenth or a twelfth of the total nitrogen. B. and F. report that wool which has been deaminated by removing the primary amino groups attached to aromatic radicles by boiling the diazotized wool with (1) alcohol, or (2) cuprous chloride and hydrochloric acid or (3) water, dyes with acid dyestuffs in the same manner as ordinary wool. The wool deaminated by methods 1 and 3 is brown, but method 2 gives it a very pale buff color. The deaminated wool, when treated with nitrous acid again, is not capable of being coupled with phenols, and contains 1.0 to 1.2 per cent less nitrogen than normal wool. For this reason they assume that the dyeing of wool with acid dyestuffs is not dependent upon the presence of free amino groups.

E. R. Trotman, *J. Soc. Dyers and Colourists 40,* 77-9 (1924), confirms B. and F.'s statement that wool loses nitrogen by deamination and obtained the following nitrogen content for normal and deaminated wools:

TABLE No. VII

Nitrogen in Ordinary and Deaminated Wool

	Normal Per Cent	Deaminated Per Cent
Sample No. 1	15.96	15.51
Sample No. 2	15.70	15.29
Sample No. 3	16.94	16.78

K. Gebhard, *Z. Angew. Chem. 27,* 297-307 (1914), in reporting upon an investigation of the constitution and dyeing properties of wool, states that the presence of a primary amino group in wool is evident from the formation, by the action of nitrous acid, of a diazo compound and not a nitrosamine. This is in agreement with the absence of any reaction between the diazo-compound and phenol and sulphuric acid, also the normal combination of the diazo-compound with a series of azo-components, and the fact that any condensation which has the effect of stopping up or removing an amino group has the effect of rendering the wool undiazotizable. Treatment of diazotized wool with caustic soda causes a brown coloration and an increase in the acidic properties of the wool which results in a loss of affinity for acid dyes, and suggests the formation of a triazone. The fact that wool has not yet been deamidized by decomposition of the diazo compound, which points to nitrosification, rather than diazotization, may be due either to ring formation between the diazo and the carboxyl groups, or reduction to hydrazine.

In support of the latter assumption is the violet color which diazotized and boiled-out wool gives with caustic soda, just like the hydrazinesulphonic acid of anthraquinone. The hydrazinesulphonic acid of wool gives an orange coloration with zinc chloride, and it is suggested that ring formation takes place. The power of this condensation product to still fix to a certain extent acid dyestuffs suggests the weakly basic properties of a pyrazolone ring. Treatment of wool with acetic anhydride seems to lead in the first instance to simple acetylation of the amino group. The wool loses its basic properties and its affinity for acid dyestuffs, whereas its affinity for basic dyes is increased. Further action causes a strong brown coloration of the wool, due to ring (lactone, miacin, pyridone) formation. Aldehydes which condense with the amino group, bisulphites which convert it into hydroxyl or sulphonic acid, and oxidizing agents which convert it into hydroxyl or cause ring (indazole) formation all have the effect of depriving wool of its basic function, as shown by its loss of affinity for acid dyestuffs and increased affinity for basic dyes.

Wool also behaves like a primary amine in forming salts, for instance, with phosphotungstic acid. This salt formation is prevented by acetylation of the wool, but is not affected by esterification of the carboxyl group. The existence of a carbonyl (OC:) group is shown by the action of hydroxylamine on wool. The affinity for acid dyes is thereby decreased while that for basic dyes is unchanged or increased. These effects can be increased by inner salt formation, according to whether it takes place between the :C:NOH residue and the amino group or the carboxyl group, phosphotungstic acid furnishing an example of the former, and aluminum acetate of the latter. That a carboxyl group is present in wool is shown by the formation of colored metallic salts and by the fact that esterification with alcohol and sulphuric acid leads to a loss of all the acid properties of the wool.

For complete reservation of wool against acid dyes, inner complex ring or salt formation involving both the amino and the carbonyl groups appears to be necessary, examples of which are the products of the reaction of wool with pyrotartaric acid, urea, or methylenedisalicylic acid, or the well-known tannin-stannous chloride reserve. The complex salt, wool oximephosphotungstic acid is also an example. Of a large number of amino acids examined by Gebhard in regard to their behavior toward reagents, dyestuffs and mordants, only those containing an aromatic nucleus, such as phenyl glycine and anthranilic acid, and particularly anthranoylanthranilic acid, approximate wool in their properties, and he concludes that a substance analogous to anthranoylanthranilic acid is the chief constituent of wool. The amino, imino and carboxylic constitution of wool is also supported by M. Saget in *Monit. Scient. 24,* 80-7 (1910).

A. Kann, *Farb. Zeit. 25,* 73-5 (1914), states that wool must contain carboxylic and secondary, not primary, amino groups, basing this statement upon the fact that after treatment with dilute formaldehyde solution, it still reacts with nitrous acid. He therefore assumes that a nitrosamine, and not a diazonium compound is formed. However, if nitrosamine were formed, the wool should

give the Lieberman nitrosamine reaction, but Trotman, *J. Soc. Dyers and Colourists 40,* 77-9 (1924), was unable to obtain this reaction from diazotized wool.

K. Gebhard, *Farb. Zeit. 25,* 279-83 (1914), questions Kann's statement regarding the amino groups in wool, as being based upon insufficient evidence, and states that it is doubtful if there is any reaction between the amino group of wool and the formaldehyde. He points out that wool consists of at least two substances, one of which is an amorphous substance of the nature of an amino acid. The other substance is colloidal and in the wool may be combined with the amino acid, as the amino group of the amorphous constituent becomes more pronounced in character on hydrolyzing. G. considers that the amorphous substance is "cemented" in the wool by colloidal constituent. He states that the protective action of the formaldehyde may be due to its rendering this colloidal constituent insoluble by coagulation.

R. Haller, *Z. ges. Textilind. 25,* 402-3, 411-2 (1922), reports experiments designed to test the theory that the wool molecule contains both acid and basic groups. He treated wool fibers with Congo Red solution and with dialyzed Congo Red acid sol. The solution dyed the wool a wine-red color, while the sol. gave very feeble but distinctly blue shades.

Trotman and Wyche, *J. Soc. Chem. Ind. 43,* 293-5T (1924), state that wool contains amino groups attached to both aliphatic and aromatic groups. From their experiments they concluded that the total amino-nitrogen of wool is about 0.7 per cent, and is greater than that lost by deamination, hence probably imino groups are present. However, Lieberman's reaction is inconclusive on wool. Ordinary and deaminated wool have the same shrinkage, elasticity and tensile strength, and absorb practically the same amount of chlorine.

Experiments on the dyeing properties of normal and deaminated wool by E. R. Trotman, *J. Soc. Dyers and Colourists 40,* 77-9 (1924), indicate that in the case of most acid dyes there is no difference in their affinity for normal and deaminated wool. While this appears to be an excellent argument against the chemical theory of dyeing, until we have more definite information regarding the deaminating reaction and its exact effect on the wool fiber, it cannot be accepted as final proof that the amino groups do not enter into the reactions of dyeing.

In this connection it may be noted that Kay and Lloyd, *Biochem. J. 18,* 1043 (1924), state that the removal of the free amino groups from skin (hides) reduces the amount of acid absorbed and combined, and that the swelling of hide in acid solution is due to the presence of free amino groups.

Knaggs and Schryver, *Biochem. J. 18,* 1102-6 (1924), suggest that when gelatin is treated with cold dilute acids or alkalies, a molecular rearrangement takes place with the formation of stable ring compounds.

R. A. Gortner, *J. Amer. Chem. Soc. 35,* 1262-8 (1913), made comparative determinations of the nitrogen in different forms of combination in black and white wool from the same animal. The only substantial differences established were an excess of 3.45 per cent of humin nitrogen in the black as compared to the white wool, and a deficiency of 2.5 per cent in the amino-nitrogen in the filtrate from the bases. He attributes the excess of humin nitrogen to the presence of pigment. However, there is no necessary relationship between the lack of amino-nitrogen in the filtrate from the bases and the excess of humin nitrogen. The total nitrogen in white wool was 16.27 per cent, that in the black wool being only 15.11 per cent. The low percentage of nitrogen in black wool is probably due to the presence of the pigment melanin (Pigmentum nigrum), which contains less nitrogen than keratin. The nitrogen of the melanin, which appears in the humin fraction, can only be a portion of the true melanin nitrogen present in wool. Apparently, therefore, hydrolysis with strong acids breaks down the melanin molecule.

The Sulphur in Wool

A great deal has been written in the technical and scientific literature regarding the sulphur content of certain proteins, particularly wool. Much of this literature concerned the supposed variations in the sulphur content of wool. The most recent and probably the most reliable work upon this subject is that of Trotman and Pell, *J. Soc. Chem. Ind. 45,* 10-12T (1926), and Trotman, Trotman and Sutton, *J. Soc. Chem. Ind. 45* 20-24T (1926), who were unable to confirm the many statements in the literature regarding the wide variations in the amount of sulphur in wool. They found purified wool to contain about 3.4 per cent of sulphur, which amount was not reduced by extracting the wool with such solvents as petroleum spirit, carbon tetrachloride, carbon disulphide, or alcohol.

From previous work, it appeared that the sulphur in wool is present in two or more forms, i. e., the smaller portion closely combined in the protein molecule and a larger amount in a more loosely combined form. One of the former arguments in favor of this theory was the wide variations in the amount of sulphur reported in wool. However, Trotman and Bell have largely dispelled this basis of argument by showing that the supposedly wide variation in sulphur content was very probably due to improper methods of analysis. The work of Trotman, Trotman and Sutton, *loc cit.,* upon the proteins constituting wool, indicates that the sulphur may be present in more than three forms. They found sulphur in each of the three proteins isolated from wool, and probably it may be in more than one form in some of these proteins.

The position of the sulphur in the wool molecule has been widely discussed at various times. Chevreul found that when wool was treated repeatedly with lime water, much of the sulphur was removed, but he was unable to reduce the sulphur content below 0.46 per cent. From this he inferred that the sulphur was present in two

forms, (1) loosely combined sulphur which constitutes about 80 or 85 per cent of the total sulphur, and (2) a firmly combined form which is not removed by alkalies. Treatment with caustic soda solution, in such a manner as not to disintegrate the fiber, removes about the same amount of sulphur. When wool is dissolved in caustic soda solution, only about 80 to 85 per cent of the sulphur in the wool is converted into sodium sulphide. These facts all point to at least two forms of combination for the sulphur.

T. B. Osborne, *J. Amer. Chem. Soc. 24,* 140-67 (1902), investigated the sulphur content of various proteins and concluded that the whole of the loosely-bound sulphur, especially in those proteins which are rich in sulphur, cannot be obtained in the form of lead sulphide. When only one atom of loosely bound sulphur is present, this can always be quantitatively converted into sulphide, but when more than one such atom is present, the results of analysis by the alkaline lead method are too low. He therefore states that there are probably two kinds of protein complexes containing loosely-bound sulphur reacting with alkaline lead silutions; the one yielding the whole of its sulphur under these conditions, and the other, comparable with cystine, present in those proteins which are rich in sulphur, yielding only a part.

P. N. Raikow, *Chem. Zeit. 29,* 900-1 (1905), reports that if wool or human hair is allowed to stand for some time in contact with syrupy phosphoric acid (sp. gr. 1.7) in a closed flask, considerable quantities of sulphur dioxide are produced. This indicates that a part of the sulphur is directly connected to oxygen atoms. He also states that the following sulphur compounds have been found in the decomposition products of the albuminoids; cystine, cysteine, thiolactic acid, thioglycolic acid, ethyl sulphide, ethyl mercaptan, methyl mercaptan, hydrogen sulphide, and according to Drechsel, diethyl thetine.

E. Grandmongin, *Chem. Zeit. 31,* 174 (1907), was unable to obtain a trace of sulphur dioxide by the action of phosphoric acid upon unbleached wool, and suggests that it is probably combined with carbon and hydrogen as in the proteids.

O. Baudisch, *Chem. Zeit. 32,* 620 (1908), confirmed Raikow's production of sulphur dioxide from wool with phosphoric acid and found that the sulphur in wool is also oxidized by neutral 30 per cent hydrogen peroxide. After five weeks' action, the presence of sulphur trioxide was demonstrated, which Baudisch thinks supports the view that the sulphur in keratin is in combination with oxygen. He also found that chlorinated wool did not give sulphur dioxide under similar conditions, which indicates that the chlorination process has a direct influence upon the sulphur of the keratin molecule. Breinl and Baudisch had previously shown that the sulphur in human hair can be completely oxidized to sulphur acid by hydrogen peroxide.

Strunk and Priess, *Z. physiol. Chem. 76,* 136-44 (1912), digested samples of wool for some time with concentrated phosphoric acid in the absence of air. The mixture was subsequently distilled in a current of carbon dioxide, and the evolved sulphur determined. By this process, less than one-thousandth part of the total sulphur was evolved as oxide and on this basis they decided that the sulphur in wool is not combined with oxygen. They also found that wool is capable of absorbing and combining with a large amount of hydrogen sulphide, and they suggest that this may be one of the causes for the variation in the sulphur content of wool, as reported by various investigators. This hydrogen sulphide is readily oxidized to sulphurous or sulphuric acid, which may account for the presence of small quantities of sulphurous acid in the wool of live sheep.

Trotman, Trotman and Sutton, *J. Soc. Chem. Ind. 45,* T 21-4 (1926), also were unable to obtain any appreciable quantity of sulphur dioxide from wool upon treating it with phosphoric acid in the absence of air.

K. Gebhard, *Z. angew. Chem. 27,* 297-307 (1914), suggests that the sulphur in wool may exist in the persulphate form between two amino groups, basing this theory upon the fact that it is easy to remove and that its removal renders the amino groups more active.

C. T. Morner, *Z. physiol. Chem. 93,* 175-202 (1914), also reports considerable work upon the sulphur in proteins. He oxidized many sulphur-containing proteins, including wool, with an excess of nitric acid, and in every case was able to isolate methylsulphonic acid, by means of the barium salt from the products. The amounts of the barium salt of this acid varied from 1.4 to 12.4 grams and bore no relation to the cystine content of the proteins. Under the conditions used in these experiments, cystine does not yield methylsulphonic acid, which certainly indicates that in every case a part of the sulphur must be present in another state of combination.

S. R. Trotman, *J. Soc. Chem. Ind. 41,* T 219-24 (1922), found that upon chlorinating wool, sulphur passes into solution as sulphuric acid, which may account for the results of Baudisch, as above.

R. Haller, *Z. ges. Textilind. 25,* 402-3, 411-2 (1922), states that wool which has been treated with sodium plumbate, on microscopic examination with dark field illumination, shows a non-uniform deposition of lead sulphide. This indicates that at least a part of the sulphur is present in the elementary state in a fine granular form.

W. F. Hoffman in the *J. Biol. Chem. 65,* 251-4 (1925), states that "Hair which has been heated with one per cent sodium carbonate for even a short time cannot be used as a source of cystine. Even though only about 25 per cent of the total sulphur has been removed, a change has been brought about, presumably in the cystine molecule, that prevents the formation of cystine crystals during the regular method of cystine preparation."

K. Klinke, *Biochem. Z. 160,* 28-42 (1925), found no correlation between the color of hair and the total sulphur or cystine sulphur content of the hair. With the exception of red hair, all the sulphur present could be account

ed for as cystine sulphur. The tyrosine content of hair more nearly paralleled the pigmentation of the fiber than the sulphur content. The tyrosine was higher in red, dark and curly hair than in blond hair, and he suggests a genetic relation between tyrosine and melanine.

The most recent and probably the most accurate work upon the sulphur content of wool appears to be that of Trotman and Bell, *J. Soc. Chem. Ind. 45,* 10-21 T (1926). Their investigation shows that possibly the widely differing results obtained by previous workers upon this subject were at least in part due to the analytical methods used. It is also very possible that the previous treatments of the various wool samples during the process of purification may have had some bearing upon the analytical results. Trotman and Bell examined samples of Leicester wether, Leicester hog, black face, Botany and low-grade web wools for sulphur content, after first extracting them in the Soxhlet with light petroleum and alcohol, and then washing them with hot distilled water. The results obtained varied with the method of analysis used, as shown in Tables No. VIII and No. IX:

TABLE NO. VIII

The Percentage of Sulphur Found in Low Grade Dry Web Wool by Various Methods of Analysis

Method	Percentage		
	Mean	Max.	Min.
(1) Carius	3.41	3.45	3.36
(2) Benedict-Denis	3.19	3.30	3.06
(3) Sodium hydroxide modification of No. 2	3.35	3.48	3.30
(4) Sodium peroxide fusion	2.99	3.06	2.93
(5) Magnesium nitrate fusion	4.36	4.40	4.32
(6) White's lead method	1.50	....	....

TABLE NO. IX

The Percentage of Sulphur Found in Various Wools by the Benedict-Denis Method of Analysis

Grade of Wool	Percentage		
	Max.	Min.	Mean*
Leicester Wether	3.41	3.00	3.29
Leicester Hog	3.26	3.02	3.17
Black Face	3.32	2.90	3.20

*Average 3.22 per cent.

These figures are the results of nearly forty analyses and they conclude that there is very little variation in the percentage of sulphur present in wool, and that 3.4 per cent is probably the maximum value. They further state that whether keratin is a definite protein or consists of more than one protein, the proportions of the constituent elements would not be expected to vary widely. Prideaux has suggested that the apparent high sulphur content obtained by the magnesium nitrate fusion method may be due to the absorption of magnesium by the barium sulphate.

Trotman, Trotman and Sutton, *loc. cit.*, treated woolen fabric for twelve hours in cold solutions of sodium hydroxide of varying concentrations and determined the sulphur removed. Under these conditions, the N/1 and N/5 solutions removed 50 per cent of the sulphur, the N/10 removed 23.6 per cent, and the N/50 20 per cent of the sulphur, while the N/100 did not remove any sulphur.

Upon soaking a piece of woolen fabric for twenty-four hours in a cold normal sodium hydroxide solution, filtering and acidifying, they obtained a precipitate which gave the reactions of a protein and contained 1.72 per cent of sulphur. When this was again dissolved in caustic solution and reprecipitated by acid, the sulphur content was 0.90 per cent, which was not altered by again dissolving and precipitating. The nitrogen content was 13.02 per cent. When it was extracted with ether and the ether tested for sulphur with mercuric chloride, no reaction was obtained.

A. W. Thomas, *Ind. Eng. Chem. 18,* 259-61 (1926), reports upon the combination of colloidal sulphur, i. e., sulphur hydrosol and collagen. While collagen and the keratin of wool are possibly widely different in constitution, they are nevertheless much more closely related than many other proteins and have many properties in common. Therefore, it is possible that the taking up of sulphur by wool, which has previously been reported, may be a very similar reaction to that discussed by Thomas. T. states that under certain conditions there is a combination of the collagen cations and the anion $xS.yS_5O_6H$ of the complex $xS.yS_5O_6H_2$. In many respects this union is analogous to that of tannin but it does not yield a true leather and most of the sulphur may subsequently be removed by extracting the leather with carbon disulphide.

(This is the fifth of a series of articles on wool by Charles E. Mullin. The sixth will appear in an early issue.)

SWISS IMPORTATION OF DYEWOOD DECLINES

The imports into Switzerland of vegetable dyes, which by official classification include dyewood, fell off during the past year from 69,600 kilos (1924) to 43,500. In 1922 the imports of these natural dyes were at the same level, 43,900 kilos, but increased to 62,000 in 1923.

SPECIAL SILK COURSE AT TEXTILE HIGH SCHOOL

A thorough course of instruction in silk is provided by the Textile High School of New York, under the direction of Dr. William H. Dooley and under the personal guidance of Joseph H. Kaskel, graduate of the Textile Institute of Weaving, Krefeld, Germany, and consulting expert of wide experience. The course has been added to the curriculum to meet the call from the silk trade for well-trained young men who are capable of developing into technicians or executives.

The Application of Resorcin in Calico Printing

Early Uses—Value in Solving Printing Problems—Use as Solvent in Discharge Printing

By A. SCHNEEVOIGT

(Translated from Textilberichte by Carl Toepler)

IN his address on "The Fastness Requirements in Calico Printing" before the last Colorists' Congress at Vienna, Dr. Lichtenstein referred to the application of resorcin in the fixing of basic colors on cotton.

The use of resorcin for this purpose is not new. As far back as 1901 Camille Favre [1] had proposed the fixation of basic dyestuffs with the aid of resorcin and formaldehyde, instead of tannin and antimony. Later, Wosnessensky proposed the use of resorcin not only for the solution of the tannin-color lake but also for dissolving or preventing the formation of the color-tannin-antimony lake. This process eliminates the tartar emetic aftertreatment and offers a simplified method along with other advantages. The patent specification states [2]: "Other alcohols, such as phenol, etc., can be used to bring about solution. Without resorcin, however, the print is less fast, since the phenols evaporate during the drying, and on steaming do not allow the desired combination—the dyestuff-tannin-antimony lake—to penetrate into the fiber. The dyeings and prints produced by this method are faster in every respect, and are also faster to rubbing than those produced in the usual manner."

Since the direct fixation of basic dyestuffs with the aid of resorcin-formaldehyde resin has not been favorably received on account of the dulling of the shades produced, the printing of basic colors with tannin-antimony and resorcin as solvent, as well as the medium for preventing premature lake formation, has been introduced by others.[3]

The author has observed, while working this process, that other problems can be solved by the aid of resorcin.

There has always been a desire in printworks, especially in those employing block and spray printing, to possess a process to fix dyestuffs without steaming, since the apparatus necessary thereto is usually lacking. To a certain degree this can be done by means of the old acetic acid process, which permits an ordinary drying after printing for the fixation. This method is still in use in the Orient, but the corrosive action of the acid vapors causes considerable discomfort to those employed. Formic acid [4] possesses these disadvantages in a greater degree. Recently, J. R. Geigy proposed glycolic acid, and especially chlorinated acetic acid, as a solvent for this process,[5] as neither one possesses the disadvantages of acetic and formic acids and, besides, produces fuller prints, faster to soaping.

The author's experiments have shown that better results are obtained if resorcin, or even other phenols are used as solvents. If the goods are printed with a paste composed of basic dyestuff, tannin, resorcin, and thickening (30 to 60 grams resorcin per kilogram of paste will hold the usual amounts of dyestuff and tannin in solution), dried, and without steaming passed into a lukewarm antimony bath, a very good fixation of the print is obtained. The process, with the necessary change in the consistency of the paste, can be used in spray and brush printing.

The use of resorcin is not limited to colors used for direct printing. It is also used, according to Wosnessensky, as solvent in place of aniline or phenol, or mixed with the latter, in the colored discharge printing with Rongalite on dyed direct grounds.

Since a number of basic dyestuffs, for example, the euchrysines, Rhodamine, and Methylene Blue resist not only the action of Rongalite, but also Leucotrope, such colors can be used with Rongalite CL in place of Rongalite C, in the colored discharging of Indigo, if not too great demands are made on the fastness of the colored effects.

An addition of 20 to 40 grams resorcin per kilogram of Alizarine Red printing paste increases the stability of the latter, and when printing on unoiled cloth, the shade is somewhat deepened.

With Nigrogene and Aniline Black, an addition of resorcin deepens the shade.

As the preceding review shows, resorcin, either as a solvent, or when used with formaldehyde in forming the insoluble resin, is a fixing agent capable of a number of uses.

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[1] Bullet. de Mulhouse, 1901, p. 124.

[2] D. R. P. 308, 815. Oct. 22, 1918. Dr. Wosnessensky.

[3] For the sake of completeness, refer to D. R. P. 312, 584, May 31, 1919. Fr. Bayer & Co., Leverkusen. The process described in this patent employs in place of antimony salts, bi-valent metals (acetates, formates, or lactates of zinc, cadmium and manganese) that form insoluble precipitates with tannin, but which remain in solution in the presence of resorcin.

[4] D. R. P. 266,243. Oct. 21, 1913.

[5] D. R. P. 371,597. March 16, 1923. J. R. Geigy. In patent application G. 56,661, the use of lactic, malic, oxalic, or phosphoric acids for printing without steaming is protected. Patent application G. 59,587 (Geigy) speaks of ethyleneglycol and thiodiglycol as not possessing the corrosive action in contrast to the chlorinated acetic acid.

Dyeing With Indanthrene Blue GCD

Procedure of Test—Determination of Hydrosulphite—Dyeing Process—Results of the Investigation Shown by Curves

By GUSTAVE DURST

(*Textilberichte*, 1925, 837-9)

Translated by Ismar Ginsberg, B.Sc., Chem. Eng.

IT is still a fact that at the present time the coloring matters that give the dyer the greatest trouble are the Indanthrene dyestuffs. In using these dyes not only is it necessary to take the greatest care in maintaining the proper proportions of dye liquor to the fabric or yarn, but it is also very important that the preparation of the dye liquor containing Indanthrene dyes, be supervised most carefully. These difficulties have been overcome in practical operations, and in fact it has been common practice now for many years to produce large quantities of textile fabrics which have been dyed uniformly and satisfactorily with the aid of Indanthrene colors. Nevertheless it is still true that meticulous care must be exercised in the dyeing process.

It is true that in practical dyeing operations very few opportunities are presented for making many experiments, for the chief aim of the dyer is to turn out fabrics and yarns which have been dyed free from all fault. The practical dyer does not therefore look with favor upon any contemplated change in the dyeing process. Progress has therefore been made mostly in the laboratory, wherein it has been possible to carry out experiments on dyeing and to obtain results, which when coupled with the practical experience of the dyer and the errors and faults which were recorded in the dyeing operations, have enabled the experimenter to reach conclusions which were of value in practice. The following work is an example of such experimentation and is intended as a small contribution to a field which is fruitful of research. Completeness of experimentation could not be thought of in this case, due to the fact that sufficient time was lacking.

One of the fastest and best known members of the Indanthrene series of colors, Indanthrene Blue GCD, was chosen for this research. The substance is a dichloroindanthrene and possesses very remarkable fastness. The tables of the Badische Anilin und Soda Fabrik, in which this color is described, indicate that the fastness to chlorine is moderate and that the fastness to hot vulcanization is only very good. The shade that is produced with the aid of this dyestuff assumes a greener tone, when it is subjected to the action of chlorine. On the other hand, the original shade returns when the cloth is washed in a cold weak solution of sodium hydrosulphite. It is a fact, however, that at times the original color does not return in its exact shade. In obtaining the light shades, which were used in the experiments carried out by the writers of this article, a special process was employed for dyeing the textile and a special composition of the dye liquor was necessary. Thus this liquor contained per liter from 10 to 12 c.c. of a sodium hydroxide solution of 40 deg. Be. concentration, and from 1 to 1½ grams of concentrated sodium hydrosulphite. The time required for the dyeing operation is from three-quarters of an hour to one hour, and the operation is carried out at a temperature between 50 and 60 deg. Cent.

In the experiments which were carried out by the writers, water which had first been softened. was employed. This is done with the express purpose of avoiding all the errors that are caused by the precipitating action of the lime salts in the water. Furthermore, a slight amount of Turkey Red oil is added, which has the effect of enhancing the regularity of the color dyed on the fabric.

The principal purpose of this investigation was to determine in what way the coloring matter was absorbed by the fiber, and what changes take place in the composition of the color bath. The matter was studied from the standpoint of the absorptivity of the fiber for the dyestuff. One factor that was given special consideration was the duration of the dyeing. The effect of change in temperature was also observed. As far as the composition of the color bath was concerned, and the changes taking place therein, particular attention was paid to percentage of sodium hydrosulphite and sodium hydroxide. It is well known that in the case of a bad color bath it is always possible to obtain some improvement by adding additional quantities of sodium hydrosulphite and sodium hydroxide to the bath. It is therefore of considerable interest to determine just how the lye content of the color bath and the proportion of hydrosulphite varies in the course of the dyeing process.

The method used in obtaining these results must first be described. The color bath was prepared in the following fashion. The dyestuff Indanthrene Blue

GCDN was used in powder form in the proportion of 0.460 gram per liter of solution. The proportions of the other ingredients were as follows: 12 c.c. of 40 deg. Be. sodium hydroxide solution, 3.25 grams of concentrated hydrosulphite of soda solution and 2 c.c. of Turkey Red oil, all figured on a liter of solution.

The pulverized color was first made into a paste with the Turkey Red oil and a little hot water. Then after a certain length of time had elapsed, the color bath was prepared with this paste and the other ingredients at a temperature of 60 deg. Cent.

Inasmuch as it is essential to see that the color bath does not come in contact with the air during the dyeing process, and hence become oxidized by its action, the yarn is cut into threads which are about 2 cm. in length, the quantity of yarn used in a batch weighing 10 grams. This mass of material can easily be stirred into the color bath so that all parts of it are uniformly impregnated with the color solution. This can be done in such a manner that the yarn mass is not brought to the surface of the solution and thus exposed to the air. This could not be avoided if longer threads are employed or if more of the yarn is used at one time.

The dyeing, carried out in this manner, gave very good results, and this process was used in all the experiments described below. The dyeing is accomplished with a quantity of dye liquor twenty times the weight of the yarn being colored, and the temperature of the process is maintained constant by the use of a sufficiently large water bath. Hence, the variation in the temperature did not amount to any more than 1 to 2 deg. Cent. Such a variation can have but little effect on the experimental results.

As soon as the dyeing process is completed, the dye liquor is poured off into small flasks. This can be done very readily without carrying along some of the yarn that is also in the flask. These small flasks which contain the dye liquor are quickly cooled off, in order to be able to pipette off samples of the dye liquor at the usual working temperature of 18 to 20 deg. Cent. The details of the analytical process will be given below. The colored yarn itself is filtered on a suction filter and the liquor that is held mechanically by it is sucked off. Then the mass of fibers is well pressed down on the filter by means of a large glass rod. After the dyestuff on the fibers has been sufficiently oxidized in the usual way, the dyeing is finished by washing the fibers and then subjecting them to the action of a boiling soap solution.

Determination of Hydrosulphite

Most of the methods employed for this purpose are carried out in a current of an inert gas, a very inconvenient operation for a laboratory in which space is limited, particularly when such tests are made but infrequently. It therefore did not appear to be worth while to install a permanent arrangement of this type. In order to get away from this difficulty, the methods employed by A. Lauterbach in his investigation on the control of the hydrosulphite vat were employed. (See Melliand's Textilberichte, 1924, pages 752, 817.)

In accordance with this article, the titration of the hydrosulphite is carried out in accordance with the Knecht and Hilbert method, and it was demonstrated that when all air was removed from contact with the sample by means of a current of carbon dioxide gas, generated from sodium bicarbonate alone, the results varied at the maximum, 2 to 3 per cent, from those obtained from the test made in an atmosphere of carbon dioxide gas and bicarbonate. We have put up with this inaccuracy of 2 to 3 per cent, and hence were able to use a simpler method, so that the only piece of apparatus required was a burette, which is directly connected with a supply vessel containing the standard solution. Such a piece of apparatus is found in every laboratory.

The solution of titanium trichloride is prepared in the following manner: Fifty c.c. of 15 per cent commercial titanium trichloride are boiled up for a period of ten minutes with the same volume of concentrated hydrochloric acid, and then this solution is made up to a volume of one liter by the addition of freshly boiled water. The solution is then filled into the reservoir which is located over the burette, and from this vessel it is allowed to flow into the burette, when required, through a glass tube controlled by a stopcock. The solution in the reservoir is protected from coming in contact with air by spreading over its surface a film of paraffine oil. In addition thereto, the fresh air sucked into the reservoir bottle when the burette is being filled with the liquid is first passed through a wash bottle, which contains alkaline pyrogallol solution. This removes all the oxygen in the air and also helps to prevent the oxidation of the titanium chloride solution.

The first step in the titration proper is the preparation of the solution of Mohr salt. To do this, 14,000 grams of the salt are dissolved in 300 c.c. of water which contains 15 c.c. of concentrated sulphuric acid. The solution is then made up to one liter in volume. Fifty c.c. of this solution are then mixed with a solution of potassium permanganate of known concentration, the operation taking place in the cold and continuing until a slight rose color remains in the solution. To this solution, which now contains tri-valent iron in the proportion of 0.1 gram per 50 c.c., 10 c.c. of a ten per cent solution of ammonium sulphocyanide are added as an indicator. The solution is then titrated by the addition of the titanium trichloride solution until the rose color disappears. The titanium trichloride solution must be added rapidly. One or two trials are generally necessary before the approximate quantity of the titanium trichloride solution that must be added all at one time can be determined.

Furthermore, a solution of Methylene Blue must

be prepared. Ten grams of Methylene Blue 2B are dissolved in 100 c.c. of water to which weak acetic acid has been added (2 grams of a 30 per cent acetic acid to 100 c.c. of water). Then the solution is diluted with freshly boiled water to a volume of one liter. The solution is then filtered and standardized against the solution of titanium trichloride in the following manner:

Twenty c.c. of the Methylene Blue solution are mixed with 6 c.c. of technical 30 per cent acetic acid and a pinch of sodium bicarbonate. Then again an additional 40 c.c. of a 30 per cent acetic acid solution is mixed with half a cubic centimeter of concentrated hydrochloric acid and a pinch of sodium bicarbonate, and this solution is added to the first one. The solution is then placed in a flask, provided with a glass stopper, and here again a pinch of sodium bicarbonate (just enough to be held on the point of a knife) is added to the solution in order to drive out the air in the flask.

Salicylic acid and oxalic acid were investigated as catalysts and good results were obtained with both of these acids. We have used salicylic acid in a practical test. Just sufficient of the acid to be held on the point of a knife need be used in the test. The solution of titanium trichloride is allowed to flow into the flask until complete decolorization ensues. The solution, which first possesses a violet blue color, becomes gradually a bluish green and brighter. The decolorization solution always has a slight light greenish color, which soon becomes darker after a few minutes have elapsed. In order that the air should not harm the solution and decompose it, the point of the burette is introduced as far as possible into the flask. The standardization of the Methylene Blue solution against titanium trichloride must be carried out at least twice, and the figures obtained must agree with one another to within 1/10 of a c.c. In titrating the vat liquor for hydrosulphite content, 2 c.c. samples are added to 20 c.c. of Methylene Blue solution, which has been admixed with 6 c.c. of a 30 per cent acetic acid solution and a little sodium bicarbonate, and then after the various reagents, mentioned above, are added, the titration is carried out in the usual manner.

The second ingredient to be determined in the vat liquor is the sodium hydroxide. Inasmuch as there is no soda present in the vat liquor, and as we are desirous of obtaining only relative figures on the sodium hydroxide present, the test may be carried out in the following simple manner: Ten c.c. samples of the vat liquor are taken and mixed with 10 c.c. of a half normal solution of sulphuric acid. The mixture is then boiled for a period of five minutes, in order to drive the sulphurous acid out of the solution, and then the acid is titrated back with the aid of a half normal solution of sodium hydroxide, using phenolphthalein as an indicator.

In the first place it was thought advisable to carry out dyeing in the same vat after every ten minutes, hence at time intervals of ten, twenty, thirty and up to sixty minutes. Then it was thought that the depth of the dyeings obtained in this manner could be compared with a series of color cards of standard depth of color. This would then enable the determination of the manner in which the color was exhausted from the vat liquor. The control exercised at the same time on the hydrosulphite content of the vat liquor then showed us that the removal of hydrosulphite from the liquor could be employed as a measure of the exhaustion of the color liquor and in fact that it would give better results than establishing the depth of the dyeings.

This can be understood from the fact that the reduced coloring matter reduces Methylene Blue on the one hand and can consequently be determined as hydrosulphite. Then a parallel decrease of the hydrosulphite content of the color liquor must follow due to the fixation of this leuco substance. A curve was drawn, in which the time was plotted as abscissae and the proportions of hydrosulphite in the vat liquor were plotted as the ordinates. From this curve it was concluded that when the normal dyeing process was carried out at a temperature of 60 deg. Cent., there was quite a regular absorption of the coloring matter by the fiber in the time period of zero to thirty minutes. Thereafter, the hydrosulphite content decreased and absorption became considerably slower, which is to be assigned to the oxidation of the surface of the vat liquor.

Results of Dyeing Process

The dyeing process appeared to be completed at the end of sixty minutes. The old vat liquors (after thirty and sixty minutes) were then tested to determine the quantity of dyestuff they contained, by repeated dyeing with fresh yarn. They were all found to contain approximately the same proportion of color. Both after-dyeings were very delicate. It therefore follows that the vat liquors had been almost completely exhausted in the first dyeing which lasted from half an hour to one hour. Hence, as far as economy of dyestuff is concerned, it would not be well to carry out the dyeing in a running bath. The authors were not able to obtain the same conclusions when dyeing piece goods in a surface liquor jigger machine. The curve obtained showed that the drop in the proportion of hydrosulphite in the vat liquor was much more marked and it was also possible to use the increase in the hydrosulphite content which was brought about by the addition of more salt.

Curves have also been drawn in which the number of cubic centimeters of Methylene Blue which are reduced by the hydrosulphite, were plotted as ordinates as this has been found to be most convenient. In this

way the authors were able to obtain graphs for the various values found in the tests.

From the supplementary tests carried out in this investigation, it was possible to conclude without any difficulty that the parallelity of the exhaustion of the dyestuff with the decrease in the hydrosulphite content of the vat liquor was not a perfect one. For when the vat liquor was simply permitted to remain exposed to the atmosphere, reduction in the hydrosulphite content took place. This is indicated by a slight drop in the second half of the time curve.

From a period of thirty to sixty minutes in, which scarcely any more dyeing took place, the hydrosulphite content of the vat liquor decreased again. The authors have made several tests for the purpose of determining the hydrosulphite decrease in the case of vat liquors which were allowed to remain perfectly quiescent. For this purpose, the normal vat liquor, prepared as has been mentioned above, was allowed to stand in a porcelain beaker of the common type used in the dyeing laboratory for a period of three hours at a temperature of 60 deg. Cent. In this case it was remarked that the quantity of Methylene Blue, which was reduced, decreased from 6.25 c.c. to 2.7 c.c., which means about 18.5 per cent in the period of one hour. The decrease in the second half of the time diagram amounted to 17 per cent in a period of one hour. This is seen to be somewhat less than in the first hour and this variation may be explained by the fact that when the concentration of the hydrosulphite solution is low, the loss of strength on standing is slower, than in the case of the more concentrated solutions.

Another factor which has an important action on the decrease of the proportion of sodium hydrosulphite in the vat liquor is the temperature. In this connection we are not considering the effect of the magnitude of the open surface area. A hydrosulphite solution, which was made in the usual manner in the cold with the customary addition of sodium hydroxide lost on standing for twenty-six hours in the cold approximately 1 per cent of hydrosulphite per hour.

Another experiment was made in which a quantity of sodium hydrosulphite, that is, the proportion contained in the normal vat liquor, was introduced directly in the dry state into the acidified solution of Methylene Blue. It was found that the content of sodium hydrosulphite in the finished dye liquor was the same as that in the ordinary alkaline vat liquor, so that when the process of dyeing is carried out in the regular manner no losses of hydrosulphite are incurred. Other solubility tests showed, on the other hand, a number of very interesting results which will be discussed later in another article.

The sodium hydroxide curve is very simple and its course was just as might have been expected. At the very beginning of the dyeing process the proportion of sodium hydroxide in the dye liquor decreased, and then remained constant at a certain definite point for the rest of the dyeing operation. This amount of sodium hydroxide dye was found to have been adsorbed by the textile fibers and is held fast in firm union by them. Hence, when the piece dyeing process is carried out in a dye liquor, whose quantity is based on a small ratio of liquor to fabric, errors will be made in the dyeing operations and the materials will not be perfectly colored. The authors have not made any study or experiments on the conversion of the sodium hydroxide liquor into carbonate of soda by the action of the carbon dioxide contained in the air.

The last study made in connection with this investigation yielded results which were plotted in a curve. This curve showed clearly the effect of temperature on the dyeing process. Practical experiences obtained along these lines in the dyeing establishments have shown that a better distribution of the coloring matter throughout the textile fiber and hence a more uniformly dyed fabric are obtained when the dyeing is carried out at a moderate temperature, that is, at lower temperatures rather than at higher temperatures. This also means that the exhaustion of the color liquor is less. From the experiments which the authors have made on this subject, it has been concluded that, particularly when the dyeing is carried out at temperatures which lie in the range between 45 and 60 deg. Cent., a potent increase in the affinity of the dyestuff for the textile fiber ensues. On the other hand, under a temperature of 45 deg. Cent., and over a temperature of 60 deg. Cent., the affinity of the dyestuff for the fiber is changed but little. The brightest effects are obtained when the dyeing is carried out at a temperature of 45 deg. Cent., while that obtained at a temperature of 60 deg. Cent. possesses almost the same degree of brilliancy. On the other hand, when the dyeing is accomplished at a temperature of 75 deg. Cent., the color is much duller. Then again, the dyeings effected at a temperature of 30 deg. Cent. showed distinct differences in color depth, as compared with those obtained at other temperatures. The time of dyeing was limited in each of the four separate experiments to fifteen minutes.

These studies are of particular significance for the circulating bath. It is easily seen that when the bath stands overnight, considerable hydrosulphite is lost. There is scarcely any more dye in the liquor and heat is likewise dissipated. It is therefore not feasible to obtain well-exhausted dyeings with liquors of less than 10 per cent concentration in stationary baths. As far as dyeings in the circulating liquor are concerned, these investigations tell much as to how far the hydrosulphite proportions can be reduced.

Linwood Green, overseer of dyeing, formerly with the Old Colony Woolen Company, Rochester, N. H., has taken a position with the American Woolen Company, Hartland, Me.

Proceedings of the American Association of Textile Chemists and Colorists

The American Association of Textile Chemists and Colorists

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SUMMER MEETING OF THE SOUTHERN SECTION

The Southern Section of the American Association of Textile Chemists and Colorists held its midsummer meeting at the Green Park Hotel, Blowing Rock, N. C., on Saturday evening, July 17. About forty members and guests were present, and a number of the largest and most important mills in North and South Carolina were represented. Leonard S. Little, chairman of the Section, presided.

M. T. Johnson reported the death of Joseph Scheur, and Mr. Johnson and Mr. Ormand were appointed a committee to draft a resolution of sympathy, with instructions to send a copy to Mr. Scheur's parents and also to the secretary of the Association for publication in the Proceedings.

It was decided by the Sectional Committee and announced at the meeting that future applications for membership from the territory embraced by the Southern Section would be passed upon and approved by the Sectional Committee before they were passed to the secretary of the section for transmission to the secretary of the parent Association for action by the Council.

Charles H. Stone reported on the progress which the Arrangements Committee is making in its plans for the Annual Meeting of the Association, to be held in Charlotte during the first part of December.

The Arrangements Committee decided to hold the Fall meeting of the section in Spartanburg, S. C., about the middle of October, and announcement to that effect was made during the meeting.

James H. Purdy, general manager of the Southern Worsted Company, delivered one of the most interesting papers that has been heard before this section. His subject was "Making, Dyeing and Finishing Worsteds in the South," and his paper is published below.

C. W. Gaddy, superintendent and manager of the knitting department of Wiscassett Mills Company, Albemarle, N. C., gave a most interesting talk on "The Making and Dyeing of Full Fashioned Hosiery."

W. L. Van Riper, of E. I. du Pont de Nemours & Co., made some very interesting observations on the guaranteeing of fast colors, and linked up his suggestion with the desirability of trade-marking goods in which the colors are guaranteed, so that the ultimate consumer may easily identify them. Mr. Van Riper's address also appears below.

A motion picture illustrating the Du Pont works was shown and created a very favorable impression in that it gave those present a clear idea of the enormous investment and equipment entailed in the manufacture of dyestuffs.

Respectfully submitted,

HARRY W. ORMAND, *Secretary.*

Proceedings of the American Association of Textile Chemists and Colorists

Making, Dyeing and Finishing Worsteds in the South

By James H. Purdy
General Manager, Southern Worsted Corporation

The title assigned to me for this brief talk places me in a rather peculiar position, because the Southern Worsted Corporation of Greenville, S. C., is the pioneer and only worsted mill south of the Mason-Dixon line, and anything I say regarding the manufacturing of worsteds must necessarily apply to that plant, due to its being in that singular position. We specialize in manufacturing fancy men's wear goods used by the best clothing manufacturers in the country for their popular-priced lines of suits retailing from $25 to $40.

Our raw material is virgin wool. In some instances we purchase the wool and have it converted into top in the East, selling our card waste and noils to woolen manufacturers in that part of the country. In this way we avoid paying freight on the noils, waste and unsalable substances that weigh from 50 to 75 per cent of the total wool purchased. Other times it is more advantageous to purchase top, especially when there are radical fluctuations in price on the downward trend. It takes considerable time to receive wool shipped from Australia and other foreign countries.

Our plant is of the most modern type and is all on one floor, which avoids unnecessary handling. The building is equipped with the latest type machinery for top dyeing. Vigoureux printing, melange blending, drawing, spinning, warp and filling preparation, dressing and slashing, weaving, drawing-in, burling and mending, crabbing, fulling and scouring, piece dyeing and finishing. As these many operations are equivalent to four distinct manufacturing plants, you can readily see that our modern plant and equipment, complete control of manufacturing from top to finished cloth under one roof, and only one profit, are the essentials that keep our plant humming away during these times when the industry as a whole is suffering much from depression.

Importance of Wool

Before I go further into the details of the different operations I will endeavor to give a brief outline on wool, which is, of course, the raw material from which worsteds are made. With the exception of our present depression, the world has always been wholly or partly dependent on wool for its clothing. I do not think the present depression in the woolen and worsted industry is due to lack of consumption of men's wear fabrics, but rather of dress goods made of woolens and worsteds. The dress goods manufacturers have not been able to hold the fair sex to their idea in style or weight of fabric, and it has caused a large percentage of the dress goods looms to stand idle; consequently most of them by now have entered into the men's wear field and in bidding to get in they have caused much depression in the entire industry. However, there is much endeavor on the part of the big men in our industry to spread optimistic propaganda and help restore the weaker end to its own, and naturally when they succeed it will mean a healthier industry in both men's wear and dress goods. Personally I feel very optimistic about its future.

It is one of the oldest industries and should not suffer from any substitutes, as there is no imitation or synthetic fiber deserving the credit of being called imitation wool. As soon as the consumer is educated to know more about wool and worsted and the styling, skill, time, and many operations required, as well as the interesting history attached to it, I feel quite sure that everyone will want to own sufficient woolen and worsted garments. The industry, in short, should feel that the depression was nobody's fault but their own. The public should be proud to "pull for wool" and will find that it will protect their bodies as well as it does the sheep's. The people to-day want to know more about everything they purchase and are willing to pay for the knowledge, and it would not cost very much per yard or garment to let them know.

Early History of Woolen Industry

Getting back again to the wool: Wool is the thick, wiry covering of the sheep. Its breeding was originally directed to improve the fineness and weight of the fleece. Merinos were used for this purpose, but such types develop small carcasses and meat of poor quality. Demand for mutton and the lack of profit in raising sheep merely for wool caused the crossbreeding of many types to suit environments and fancy, with the object of founding the best type to give the greatest financial return to the sheep grower. The efforts have been most successful in the United States, as good mutton sheep are of first, and the quality of wool of second consideration.

The chief value of wool lies in its ability to be spun into yarn; other animals produce textile fibers, such as the goat, alpaca and camel, but for general purposes these are not nearly so useful to mankind as the wool from the sheep. Wool of Merino sheep has become the important element in the fabrics of the civilized world, and while it is true that they are a native of Spain, yet it is a historical fact that they were greatly improved by crossing with Italian sheep, which were brought into Spain during the reign of Emperor Columella. In A. D 711 the Saracens, a prosperous people, established themselves in Spain, living in barbaric splendor and reveling in luxuries then unknown to greater Europe. Among the industries which their extravagant living fostered

was the woolen industry, which increased to such an extent that in the thirteenth century there were in the small town of Seville more than 16,000 looms. A century later we find the woolen industry fully established in the northwestern part of Spain and the fine cloths of Barcelona, and Tortosa and of Perpignon in France were renowned all over Europe for their excellence.

The Saracens being driven away from their Spanish strongholds, the industries they had so liberally supported vanished. It is said that Ferdinand V banished 100,000 artisans because they were Moors, and Philip III drove out three-fourths of a million, the majority of them being weavers and their families. The busy hum of Seville's 16,000 looms were forever silenced. Many times since, Spain has endeavored to revive the industry, but without success.

Structure of Wool Fiber

The structure of the wool fiber under the microscope shows three distinct parts:

Epidermis or outer surface of fiber, consisting of a series of scales laying one upon the other, having saw tooth edges or serrations, which give the fiber its spinning and felting properties. Crimp of fiber also influences the spinning property.

Cortex or middle of fiber, composed of elongated cells shaped angularly. This part furnishes most of the strength and elasticity.

Medulla, the pith or core of the fiber through which it receives the juices which nourish it.

Some of its properties and characteristics:

Felting: The serrations make felting possible and it is generally brought about by milling, which causes friction, thus imparting heat and moisture; this softens the epidermis or scales.

Tensile Strength: Fairly good, but not as strong as many other fibers used in textiles.

Elasticity: More elastic than any other textile fiber.

Luster: Coarser the wool, more the luster.

Color: Varies according to the breed and the soil on which the sheep are pastured and the climatic conditions in which they are raised. There are some natural colored wools varying from tan to almost black. These wools usually bring lower prices, as their use in manufacturing is limited. This natural color is claimed to be due to pigment matters in the medulla or core of the fiber.

Length: The finer the wool, the shorter the fiber, which pastories from one to nine inches long.

Diameter: Finer the wool, the finer will be the diameter, which varies from .0018 to .004 inches.

Softness and Pliability: Vary as do the length and diameter; the finer wools are softer.

Waviness and Crimp: Called crimp in fine wools; waviness in coarse wools.

Chemical Composition: Averages 50 per cent carbon, 7 per cent hydrogen, 18 per cent nitrogen, 22 per cent oxygen and 3 per cent sulphur.

Heat causes expansion and under high temperatures wool is made harsh, brittle and very tender. When heated to a temperature of 260 deg. Fahr. with water under pressure, and dried, it can be rubbed into powder. As a conductor of electricity and heat, wool is very poor, but is a good generator of electricity. These very properties show that wool used as clothing holds back the heat of the body and keeps us warm.

Yolk, in the fiber before shearing or processing, serves as a protection to the fibers, preventing them from felting while on the back of the sheep.

The world's supply of sheep consists of over 200 different types and total number of sheep are estimated to be as follows:

Europe	175,000,000
Ainst New Zealand	109,500,000
Asia	110,500,000
Africa	42,000,000
North America	70,000,000
South America	51,500,000
	558,500,000

The world's consumption of wool is estimated at three billion pounds annually. Some of the principal wool markets are Boston, London, Liverpool, Sydney, Melbourne, Brisbane, Adelaide, Geelong, Wellington, Buenos Aires and Montevideo.

Grades of Wool

The wool is received in bales and each fleece is rolled up into a ball usually tied with paper twine. This is used to prevent any unnecessary vegetable matter from becoming mixed with it, such as would come from a vegetable twine as hemp or cotton. It then goes to the wool sorting room where each fleece is sorted according to instructions, depending on count and quality desired. The longer staple wools are adapted to Bradford worsted spinning while the shorter stapled wools are mostly used for French system. There is great variance in a fleece, the same as in the quality of mutton. The shoulder of mutton is finer in grain and more delicate than the leg and so is the wool from that part, owing to more wear and tear at the haunches than at the shoulders, for the weight is chiefly where the sheep lies down; consequently the wool there is longer and stronger. If the wool were as long about the neck as at the tail the sheep would not

get through hedges and briers, and it would also be weighted down while eating; therefore, nature provides that the wool shall be short and fine, just enough to keep the animal warm. The wool on the back becomes rough and thin, being most exposed to the rain, and because it naturally divides down the ridge of the back, it falls down the sides.

The range of qualities are not the same in sheep with fine wool as in those of stronger breeds. The different breeds of sheep may be well compared to the keyboard of a piano; each sheep has its octave of qualities but the octave of the Merino sheep is very high while that of the Lincolnshire is very low. The sorter is furnished a number of baskets equal to the number of sorts or qualities he has to make and then spreading half a fleece on the floor before him he proceeds to clip off all pieces of tar, dried dirt, etc., and then separate the fleece into its different qualities. A perfect knowledge of these sorts can only be gained by years of experience, but when once acquired the sorter knows as well by his hands as by his eyes where he shall divide the fleece, for it is not merely the coarse and fine of the fiber that guides him but also the "soft" and "kind handle" as it is called.

Wool Washing

The impurities in wool may be classed as: First, Yolk or wool fat; second, suint or sheep perspiration; third, dirt. Yolk is insoluble in water but soluble in volatile solvent, e. g., benzine, ether, carbon bisulphide. Yolk does not (like ordinary fats) form soluble soaps with alkalies but emulsifies and on this property is based the usual scouring processes. Suint consists of potash salts of certain acids that are soluble in water. Hence steeping removes the suint. There are three general methods of treating the wool:

A. By dissolving the yolk with a volatile solvent and washing with warm water to remove the suint.

B. By scouring with alkaline agents.

C. By steeping to remove the suint and scouring afterwards to remove the yoke.

Some wools shrink as much as 70 to 75 per cent in scouring. Wool scouring is a very important operation and great care must be exercised at all times so as not to overtreat the wool while trying to thoroughly cleanse it. A sample of properly washed wool from each bowl is put at each nip for comparison to enable the scourer to keep up to the required standard of work. Soap and alkali must be added methodically and carefully so as to keep regular strength in the bath. It is very important that all alkali is removed before drying because as it becomes more concentrated and hotter it damages the fiber. Overheating of wool causes loss of strength, color and handle, even below 212 deg. Fahr., and decomposes at 260 deg. Fahr.

Carding and Combing

From the scoured wool bins it is trucked to the card room where it is fed to a carding machine which consists of a number of cylinders of varying diameters and speeds running in opposite directions. This process is the first to open the fiber and throw out foreign matter and partially lay the fiber in parallel form. The by-product of the wool made during this operation can be used in making woolen yarn. The wool, now in the form of card sliver, is run through a gill box which straightens and draws out the fiber. These balls of sliver are then set up in back of a doubler or punch box and prepared in large balls consisting usually of four ends so they can be placed more conveniently into a revolving rack on the comb. The Noble comb is used in Bradford spinning. This comb consists of one large revolving circle set with upright pins and two small circles inside the larger one placed opposite each other so as to nearly touch the larger circle. The operation of the comb as indicated by its name is to straighten and comb out the shorter fibers from the continuous strand of long fibers, producing what is called top. The shorter fibers are known as noils and are of great value in the manufacture of woolen yarns.

Dyeing

The top is now ready to enter the dyehouse to be dyed or printed a shade according to the mixture it is intended for. Most of our mixtures are composed of 5 to 7 entirely different colors. Each individual shade used to make these compound mixtures must previously have passed through our laboratory for tests from practical-size dyeings before ever going into merchandise. It is important that they remain bright in all kinds of weather and sunlight. The test for this is thirty days' exposure of a sample on the roof. They must also prove their fastness to crabbing, scouring, milling, potting, perspiration, etc. These tests are many and severe but we make a practice of purchasing the best dyestuffs obtainable, regardless of price, because if the color does not hold up, a hundred other operations before and up to the manufactured garment are all sacrificed. Poor dyestuffs are not economical, no matter how cheap.

For top dyeing our tops are wound on spri[illegible]ht [illegible] and placed in the latest type Franklin top dyeing r[illegible]n A. [illegible]es. The machine is filled with water and brought [illegible] then [illegible] and the required amount of dyestuff and chemicals [illegible]d in a receiving tank and pumped through the top from the outside in seven minutes and from inside out in seven

minutes alternately until the required shade is properly developed. You can depend on this type machine giving two sets in a 10-hour day on fast chrome colors such as we use. The machine is easily unloaded and the top is then ready for backwashing.

The backwashers consist of four bowls for soap application and rinsing, passing through a dryer on an apron. This dryer is heated with coils and equipped with fans that force a perfect circulation of fresh warm air and so regulated as to prevent too rapid drying, leaving enough moisture therein to prevent losing any of the "kind handle" which the wool naturally has. Coming from the dryer it passes through a balling gill box which consists of two sets of rollers with a series of pinned steel bars working between. These bars are termed fallers. The back rollers bring the material fed between two conveying aprons slowly into the machine. Emerging from the back rollers the material is pierced by the fallers, which are working at a greater speed, and is combed or opened by them. It is soon released by the back rollers and then carried forward in the fallers to the more quickly revolving front rollers. By these it is drawn continually through the fallers, this time at the opposite end of the staple and is conducted out of the gill box.

All dyeings of the same color are blended, making a solid blend of the entire lot. These tops of different shades are then set up according to the percentages required to make the desired ground shade and are recombed to remove any fibers matted or crossed during the dyeing and previous operations after the first combing. They are then set up from cans to a French intersecting Melange gill box composed of four heads, ten slivers to each head, coming off into one sliver, making the most thorough mixing possible. When used in this manner it is possible to mix the most contrasting shades and variety, which shows its value in the evenness of the fabric.

Vigoureux Printing

Going back to the dyehouse, there is another interesting process called Vigoureux printing, which consists of applying color by printing arranged on a gill box. The fibers are drawn out in a wide sheet and pass through two rollers; the lower roller is covered with felt and the upper is engraved crosswise or crisscross so as to apply any given percentage of color. You must have a different engraved roll for each percentage. The dyestuff must be specially prepared with such ingredients to form a paste that will carry the dye and chemicals with such consistency as to enable the rolls to properly print the fibers. After the sliver is printed it is folded automatically on cloths of open construction and then tied up and placed in a large steam box. These bundles are arranged on top of each other and compressed between so as to prevent air spaces. When properly filled the lid is released and the wool is totally enclosed. Steam of proper pressure is then forced from the bottom up, passing through each fiber for a period of time and then the wool is lifted out and opened for the same periods for oxidation. This is repeated until the color is properly fixed and developed in the fiber so as to stand the necessary tests as required by our other colors.

Compound prints, blended with other colors give very desirable effects. These tops are then rinsed before backwashing and undergo the same treatment as the colored tops previously mentioned. The Vigoureux and colors are now completely blended and prepared for the drawing. This arrangement is very simple but requires constant supervision. It is merely to reduce a thick sliver, then a number of slivers of wool, down to one so small that it can be spun into a thread without an excessive draft and at the same time leave it so that the thread will be all one thickness. This is done and can only be done by a pair of back rollers revolving slowly, drawing the wool in and feeding a pair of front rollers which revolve quickly and draw the wool out. The operation is repeated for a number of doublings until the wool is brought down to a small diameter, weighing a required number of grains per yard, and is called roving. All sorts of drawings do this, but there are differences in the methods and other details.

The object aimed at in worsted spinning is the production of a regular yarn from the roving supplied, of a desired thickness or count and of requisite strength, handle and appearance, and next, the winding of this yarn in a convenient form for preparation.

The spinning machines draft the roving in order to effect the reduction to the count of yarn necessary, twist the drafted sliver to impart strength and handle to it, and wind the yarn on bobbins for further use. These operations are continuous, the drafting accomplished by rollers and twisting and winding-on by spindles.

Preparation of Warps and Filling

From the spinning the yarn is run on the large packages through slub catchers, doubled and ready to be twisted in a two-ply yarn. After twisting the warp and filling yarns they are spooled on multiple jack spools and at the same time every last thread is personally examined by a skilled operator, who removes any type of imperfection that should appear. The yarn is now ready for preparation of warps and filling.

The patterns are set up for warping and fine silk decorative threads are added to prepare what is known as the warp; they are the ends which travel lengthwise in the cloth. The threads that travel crosswise are known

as filling or weft. These warps are then set up in a frame up on which is a set of harness frames containing heddles. Each individual end is passed through a separate heddle in accordance with a draft made out by the designer. There is one place for each end to be inserted and it must be right or it will probably have to be lifted out of the loom and redrawn. The ends are then drawn through a reed fastened in the lay of the loom; its purpose is to beat up each pick of filling inserted and keep the warp to the required width. Before a warp is started in the loom three inches of cloth is woven, taken off and examined carefully by the boss weaver and designer to make sure that the proper yarns, proper pattern and construction is as called for.

When the cloth is removed from the loom it is examined carefully on the face by one examiner and at the same time is what we call through-lighted so any imperfections that appear may be immediately seen. It is important to speed this examination by having an extra man at this position to prevent accumulation of pieces at the perch, especially on making up day. For instance, if a wrong draw would show up in a piece and that piece were left to hang around at the perch, a second piece could carry the same imperfection all the way through and would mean the most of mending two pieces instead of one. Many mills could cut their mending 20 per cent by closer supervision of the examining perch.

The cloth is then passed on to the burlers, who pull the cloth over a flat table and feel for the knits and raise them all to the back of the cloth. If this were not done in a latter operation when shearing the cloth to remove surplus nap the cloth would be cut at every knot.

After the cloth has been burled for knots it is then examined to make sure the burling was properly done. At the same time any imperfections showing are marked in chalk and the piece is passed to a skilled mender. If an end is missing or a pick broken this mender, who understands the various interlacings of the different weaves, sews in each missing end or pick. This operation requires good eyesight and extreme patience. The cloth is then re-examined to make sure it is in perfect condition and if not it is returned to the mender to complete.

Finishing

The cloth is now ready to be finished. This operation is entirely in accordance with the finish required, but any finish will do as an illustration. The cloth passes through what is known as a continuous crab. This gives quick changes from hot to cold water and gives a desired set to the cloth, preventing crocking and unnecessary shrinkage after the goods are finished. It also sets the cloth to prevent milling streaks, washer breaks, etc., and enables the cloth to take on a uniform finish that it will not do in all cases if not crabbed. In some fabrics it is necessary to perform this operation from two to four times in the course of finishing. The nature of the stock has a lot of control over this operation.

After crabbing the cloth is then put in the fulling mills and run through two-flanged rollers on which is a spring and weight, and with the aid of a good fulling soap and heat caused by the friction the goods are felted to lose a given yardage to produce a desired finish.

Scouring

After being fulled they are put in the next machine which is the scouring. Here they are run in a warm water of even temperature and additional soap used to work up a good foamy lather. They can also be adjusted to certain tensions, regulated by the adjustable pot eyes through which they pass to enter between two heavy wooden rolls. This operation thoroughly removes all dirt and brings out the decorative silks which add snap and show up the style. From here they are again crabbed and an added set put in them after being felted and scoured. They are now ready to pass over the vacuum extractor, which removes by suction all surplus water without causing any breaks or wrinkles, as in a devolving or centrifugal extractor. The goods then pass through a massive dryer and are thoroughly dried at a low temperature. This prevents any harshness or harm to the fiber and maintains that natural kind handle which can easily be lost on old-fashioned machinery and careless operation.

After the goods are dried they are brushed so as to remove the nap that has felted down, that it may be easily removed when shearing. The goods, thoroughly brushed and sanded, are trucked to the shears, where they are first sheared on the back to remove the knots that have been raised by the burler. The cloth is usually given two to four runs on the back and four to eight on the face. The shearing removes all the stray fibers and imparts a clean appearance. The cloth is now taken by girls called speckers who look thoroughly over the cloth and with a pair of sharp tweezers remove all specks and straws that appear. The cloth now gets a rest for a day or two, to come back a little to its own, and is conditioned. It is then run through a large heavy duty press and the finish is finally applied. It is set on rolls for twenty-four hours and goes through a final examination, and if there is anything that shows that would not look desirable on the lapel of a man's coat an allowance is made by inserting a string in the selvage of the piece and deducting one-eighth yard for each string from the gross yardage.

The cloth is now wrapped on boards and packed and shipped to all parts of the country. These operations are performed by a skilled organization that we feel very

proud of. It is composed of 100 per cent white, English-speaking people. There is hardly an operator who does not recall seeing his grandmother take the raw wool and with the aid of the old-fashioned spinning wheel and hand loom convert it into different fabrics for use in their own homes. I have had the pleasure of seeing many of these fabrics and drafts which have been handed down which show remarkable skill. They are a very conscientious people, quick to learn, take great pride in their work and are always willing to co-operate.

The Increasing Demand for Fast Dyed Fabrics*

By W. F. Van Riper,
E. I. du Pont de Nemours & Co.

Gentlemen: What are we doing to supply the increasing demand for fast dyed materials? How many mills that you know of are now producing fabrics that are being offered to the public with a guaranty against dissatisfaction so far as the colors in them are concerned?

No doubt many of you have often asked yourselves these same questions recently. Some of you have already decided that the time has come to act, and, of course, many mills are now producing such guaranteed lines, but the sad fact is that there are a large number who still doubt the existence of such a demand. It is to those that I would speak particularly.

I would refer them first of all to the conclusions reached by the Good Housekeeping Institute, as the result of an extensive canvass recently carried out by them, the reactions of which are set forth in an editorial article, "Colors That Do Not Fade," in the June, 1926, issue of that journal.

One of the hundreds of answers indicative of the trend of feeling among home buyers reads:

> I am now buying only those brands that have proved themselves in my home. This may sound like boasting for certain brands, but I feel that the manufacturers of these deserve all credit for producing for the home dressmaker a material that is dependable. *I always ask for fast colors* and now refuse to spend my time on any but brands I know.

And another writes:

> My experience has been entirely with one line, as it happens to be the fast color line that my dealer handles, but I should expect any other *guaranteed line* to do as well.

A further conclusion of the home buyer, born probably of sad experience, is as follows:

> I rely on a manufacturer's guaranty much more than on a saleslady's word. The salespeople come and go, and you can't prove to the next one what the last one said. One finds salespeople with vague ideas about the fastness of color. *I ask for a trade-marked article* and have never yet found it necessary to claim my return privilege.

And we read in the final paragraph of this article the conclusions and recommendations of Good Housekeeping to its million and a quarter readers in the following words:

> The slight difference in price between truly fast colored fabrics and those that will fade make the former a really economical purchase. Price is not proof that colors are fast, however. The fastness of color in any fabric cannot be predicted by the buyer. Guaranteed, trade-marked goods that will consistently measure up to high standards of fastness are, in our opinion, the *only purchase* that can be depended upon.

That strikes me as being straight from the shoulder and a bit of concrete advice given to your ultimate consumers, that you, as manufacturers, cannot afford to disregard. In other words, the real buyers of the country are beginning to demand three things of the colored fabrics they purchase: First, that they be dyed with fast colors; second, that manufacturers trade-mark their goods so they can be easily identified, and last, that the fabric bear a guaranty of color fastness. Truly a big order, but one worth bidding on.

We hear the same story from other sources. For instance, only a few days ago a personal canvass was made of several New York department store buyers and it is interesting to read some of their statements.

One buyer representing a popular priced store says:

> When we buy any of the middle-priced or higher-priced goods, we always insist that, first of all, the goods shall be fast with respect to the elements to which they are exposed. People who buy cheaper priced goods don't expect them to be fast. However, *the majority of people* buy the better quality materials which they know to be guaranteed fast.

Here is a statement from the buyer of one of the cheaper grade department stores:

> We carry ——— line and have realized a large increase in profit since we have had it on our counters. Sometimes they have forgotten the name and so ask for "that material that is advertised to

*An address delivered before the Southern Section of the American Association of Textile Chemists and Colorists, July 17, 1926.

be guaranteed fast." I feel that in general fast dyed goods sell better than those not having this guaranty.

There are several others I could tell you about if time permitted, but just let me read an interesting prognostication by one of them:

> The better class of people who look for values rather than bargains are willing to pay a few cents more for a piece of merchandise if they believe that in doing so they are getting something that is worth that much more in actual value.
>
> As for the better class consumer, they want fast dyes. But a good many of them buy stuff which they believe to be truly fast, but which is only partly so. There is a wonderful market for fast dyes among this class of consumer.
>
> There has been a tendency in the last few years toward the use of fast dyes exclusively and this is growing more and more each year. I would venture that in five to ten years every piece of washable goods manufactured will be guaranteed absolutely fast.

So we see a growing satisfaction on the part of the buying public with anything but fast-dyed materials; a dissatisfaction which is recognized and acknowledged by both retailers and wholesalers.

This demand for guaranteed colored fabric has also reached the mill owner. Some have met it with just what is wanted, but they are the exception.

Now, how textile mills develop this potential market is their own job, and a big one; our only interest as dyestuff manufacturers being, that you realize that we are constantly endeavoring to make available to you an even wider range of the fastest of dyestuffs, with improved qualities. This, too, is no small task, but our progress along these lines is constant and is reflected in the United States Tariff Commission's "Preliminary Report of the Census of Dyes and Other Synthetic Organic Chemicals" for the year 1925, in the following excerpt:

> The outstanding features of the year were (1) continued recessions in dye prices due largely to the severe competition between the domestic manufacturers; (2) *conspicuous progress in the manufacture of fast dyes,* many valuable dyes of high fastness being produced for the first time in the United States in 1925. The output of vat dyes (other than indigo) exceeded 2,500,000 pounds compared with 1,820,000 pounds in 1924. This class of dyes is used largely on cotton and yields shades of exceptional fastness. *This increase is of special interest as indicative of the pronounced trend toward an increased use of fast dyes.* . . .

And the 1926 report will show at least as great a continued improvement as that recorded for last year. In other words, with a strong determination on your part to get your share of this fast color business, there is nothing that can stop you, for the domestic dye industry is now producing the colors that will allow you to guaranty your trade-marked fabrics.

If we both work together it will not be "five to ten years before all colored materials will bear a guaranty similar to that used by one of your wisest:

> These goods are dyed with the fastest dyes money can buy. Wear and tear and the laundry will eventually take their toll of any garment made, *but these colors will stand up as long as the cloth remains.*

Resolution

Whereas, the Southern Section of the American Association of Textile Chemists and Colorists has been saddened by the death of Joseph Scheuer, be it

RESOLVED, First: We extend to the bereaved family the sympathy of the Southern Section;

Second: We do hereby put on record our appreciation of the deceased; his attendance and interest in the organization was of help to others;

Third: That copies of these resolutions be entered on our minutes, published in the Proceedings and sent to the family of the deceased.

M. T. JOHNSON,
H. W. ORMAND,
Committee.

Applications for Membership

Active Membership

Clark, J. Andrew, instructor textile chemistry and dyeing, Rhode Island School of Design, Providence, R. I. Sponsors: C. I. Milnes and J. W. Clark.

Hall, Frank E., color mixer, Consolidated Piece Dye Works, Paterson, N. J. Sponsors: W. E. Mitchell and Wm. C. Hall.

Junior Membership

Snowden, Donald C., dyer, Cadet Knitting Company, Philadelphia, Pa. Sponsors: B. K. Archer and H. E. Tillson.

The Dyer's School of Experience

[EDITOR'S NOTE.—*The following narrative is one of a series being published under the general head of "The Dyer's School of Experience." Realizing that the genuine material for such a series is to be found largely among its own readers, The* REPORTER *solicits contributions from that source and will pay for those accepted at regular space rates. Among the readers of this journal there should be many who have, in the course of their experience as dyers or chemists, encountered incidents which should prove most interesting and helpful to their fellows. Send all manuscripts to* AMERICAN DYESTUFF REPORTER, *90 William Street, New York City.*]

A DYEHOUSE TYRANT

By NOEL D. WHITE
Davenport Hosiery Mills, Chattanooga

WHILE I was working for a small mill in a Pennsylvania town, my family growing and my salary being barely enough to support it, I decided to look around for a bigger job.

An ad in a textile magazine attracted my attention. It was for a dyer to take charge of a weighting and dyeing department in a large and long-established mill in New England.

I managed to get an interview with one of the proprietors, and met him one Sunday morning by appointment in his home town in the presence of his general manager.

I was told that they had to send about two thousand pounds of silk to Paterson, N. J., every week to be loaded and dyed, because it could not be dyed successfully in his plant and it was his desire to have it done here if it could be done.

After learning about my experience in that line he told me he was willing to let me try it. He told me what my salary was going to be (considerably higher than I was getting) and he said that I was to receive but twenty dollars a week in my pay envelope. The balance he would keep in his office to be claimed by me at any time I needed it, explaining that he did not want to excite the jealousy and envy of the super and the other dyers by my drawing a larger salary than they did.

I thought that was a queer arrangement, but said it was agreeable to me. And after paying me twenty-five dollars for my expenses and telling me to report in two weeks, he left me in care of the manager, who was to take me to the dyehouse and show me the works.

This gentleman took me in charge, and together we walked to the dyeing plant, ten minutes from the mill, on the outskirts of the city.

He told me they had just finished building this plant—big enough to employ about two hundred men—and that their work consisted of sewing silk, machine twist, embroidery silk fast to washing, tram and organdie for linings and dress goods, this latter to be weighted up to 24 ounces. Nearly all had to be sent outside to be dyed, and he thought when they had such a large dyehouse, with all the conveniences possible in it, up to date in every respect, it did not seem reasonable that they had to continue shipping silk outside to be dyed, losing so much time in going and coming.

Then he told me that the dyehouse superintendent had built himself up to this position. He had started to work with them when the dyehouse was a small room attached to the mill, and they were doing nothing but twist and sewing silk. He had learned under an old dyer they had had then, and as the mill had grown and new additions were added to their manufacturing plant he had grown with them and had learned all there was to be learned there. But he had never worked any place else, and naturally was not supposed to know all the latest ways of loading and dyeing silk. Here he added that he did not think this man would have any objections to my going there to do the work he was not well acquainted with himself.

Again I thought that was funny, but said nothing; and at last I started back home, elated over the prospect of the future.

Two weeks later, early on Monday, I reported at the dyehouse for work. I asked to see the super, and told him who I was and what I had come to do. He showed surprise and said he had not been advised that a man had been hired to do the weighting in the dyehouse; that he was doing that and he thought he was going to keep on doing it. As far as he knew, he said, there were no complaints about his work and he did not know why I had been hired.

I was nonplussed. I could not understand this situation; there was a misunderstanding somewhere. I told him I was going to see the manager at the silk mill and find out what was wrong.

When I found the general manager he told me the dyehouse super knew nothing of my coming, but that he would presently go with me to the dyehouse and explain everything to the super; also, that I was to be given full charge of the department where the vats and machines provided for the tin weighting were situated. I should arrange everything to suit my requirements, and anything I needed I should order through the super. I would find him a very nice man and should get along with him as best I could.

So together we went back to the dyehouse. I was properly introduced and the purpose of my coming explained to the super, who was told that his duties were already too many and that the management had in mind to keep all their work at home. I was to do my work in my own way without any restrictions. He said he was going to send some silk directly so that I could begin work.

The silk came in due time; but that day I did not start working. I looked around to make myself familiar with my new place and see what was needed. The super

showed me all around the different rooms. There was a dyehouse for blacks, one for colors, a big room for boiling off silk for dyeing. It was the best appointed dye plant for skein dyeing I had ever seen, and I was ready to rejoice that I had a chance to work in such a place with such a promising position as I had secured.

But I was soon to regret I had left my little dyehouse in Pennsylvania. After taking stock of the chemicals, I went to the super to ask him where the silicate of soda for the loading was. He told me he had none; never used any; but would order some if I wanted it. I told him I did.

I found that they were buying the bichloride of tin, 52 deg. Tw. strength. I told him that as that was the strength I used in my vat, it was advisable he should buy it for me at no less than 60 deg. Tw. strength.

The second day I boiled off fifty pounds of tram to prepare it for my first trial. That was all I did that day. At lunch time I was surprised to see among the employees an old acquaintance of mine. He had seen me around and was wondering what I was doing in that place. I informed him to what work I was assigned. He shook his head and said: "If I did not know you I would keep my mouth shut, but to you I will give a piece of advice: Don't make any effort to move your family here, and start now to look for another place. You will not last here more than three weeks. That super is the worst scoundrel in the country. I have been here over ten years and have seen many good dyers come here and leave in less time than I gave you. The reason I remained so long is that my family is small and all are out of my care; the climate here is the most suitable for my health, and I have learned to take his bullying philosophically. He has succeeded in breaking down the rest of the dyers in spirit, and now they believe they can't hold any job anywhere else. Take my advice and lose no time. Look for another place before he breaks you, too."

That night I wrote home that the place was not so good as I had first thought.

The third day the super asked me why I did not go ahead with my weighting. I told him I was waiting for the silicate to arrive. "By the time you are ready for it, it will be here," he told me.

I went to work and gave my silk three passes in tin and three in phosphate. At this time I went to the super and told him I was ready for the silicate. He told me the silicate had not come yet; that he never used any and I could finish my lot without it; that the mill was in need of that lot and there was no use waiting any longer.

He had never ordered any silicate and did not intend to —not for me. He had tricked me in starting, knowing my job would be incomplete. Plainly, he did not want me to succeed. Then I found opposition on every hand. The engineer, who was supposed to help me fix up my department, at my very first request told me he was not paid to obey my orders, and made me see plainly that he did not like my intrusion. I found that everyone who had any position of responsibility here was a relative of the super and held his job not through merit but through relationship to him. No wonder they were all showing their hostility to me!

Remembering what my friend had told me, I decided to do what the super told me to do; that is, finish my lot as it was and see what would happen. I soaped it as he had been doing and proceeded to dye it to the sample I was given. When dried and finished the returns were 22½ ounces weight. To me it was above my expectation; but he said it was too light; that the mill could not use it so light and he was going to put it into black. I told him he could do what he pleased with it; that as I had not received the silicate in time, this was not a fair trial for me, although the result was better than anticipated under the circumstances. Then he said he needed a dyer in his color shop and would I go there and work for him. I wanted to say he was the last man on earth I wished to work for; but the loved ones at home came to my mind, reminding me I had no other job yet and no funds to support them if I was out of work, so I told him I would.

At lunch that day I told my friend what had happened and that I was going to work in the color shop with him. "He will break you so that you will believe you never knew how to handle a dipper," he told me.

That night a letter from my wife informed me that the dyer who had taken my job in Pennsylvania was not giving satisfaction, and the super there had told her I could go back if I desired it. That was, indeed, welcome news.

The work which the super assigned me was dyeing sewing silk. Five years' experience in that line when I was in Montreal, as I wrote in a previous instalment, made me proficient in that work.

Nevertheless, I found out what my friend had meant when he said he was going to break my spirit. As he was to pass on my matching, he would never accept a color unless, for one reason or another, he had sent me back to improve it half a dozen times. At first I thought my eyes were not as good as his or as they used to be. Then I caught my friend smiling, and in passing he asked me if I could not see he was making a fool out of me. But my mind was made up to stick it out until I had arranged to get my old job back.

One morning the super showed me a postcard from Italy saying it was from his son, who was traveling abroad on his way to Leipzig, Germany, where he intended to enter a university to finish his study in chemistry. He went on telling me how proud he was of this boy, who had graduated with honors from Yale, had gone to another college to study chemistry and now he was going to complete his education abroad. After that he was going to visit all the factories where they made dyestuffs. He had obtained letters of introduction from the Bayer Company, the Badische Company, H. A. Metz & Co., and all the rest. By the time he came back he was going to be the best informed technically, and practically the best dyer in the country.

Three weeks after I had started in this place I got a letter offering me my job back at home. Next day, instead of reporting for work I waited for the office at the mill to open and went to see the man who had hired me and told him his dyehouse was too small for me and his super. He smiled and said he was a hard man to get along with. He paid me the full week and gave me the rest of my salary he was holding back for me. Then I went to the dyehouse to say good-by to my friend and the super. The last words I said to the latter were: "I hope someone will treat your boy the same way you have treated me here."

Little did I dream then that I was to be instrumental in making a monkey out of his son in the days to come.

He had entered an institution of learning in Leipzig, then had gone visiting the dyestuff factories as per schedule, and just before the beginning of the Great War had come back and gone to work in his father's dyehouse.

I had gone back to Pennsylvania to my old job, and from there had gone to New England to the job of which I wrote in my first episode.

When I left that job, as you remember, many dyers had tried unsuccessfully to fill it, and this man happened to be the last one who went there, so highly recommended to be such a skillful, highly trained, experienced dyer that, according to the superintendent of the plant, who wrote me, they were afraid to hire him, fearing such a man was more expensive than they could afford.

I had made that job so exacting that after three months' trial they had to fire him for inefficiency and give up the dyehouse in disgust. I was well revenged. I wonder what his father said when Sonny went back to him and told him it was I who had made such a success of that job which he could not hold!

Having made a failure of his first venture out of Papa's sight, he gave up dyeing and got a job selling dyestuffs for a small dealer.

IMPORTS OF BACTERIOLOGICAL STAINS

Imports for consumption, through the port of New York, January to June, inclusive, 1926, of bacteriological stains, reagents, and fine organic chemicals of coal-tar origin, dutiable under paragraphs 27 and 28, Tariff act of 1922, according to the Chemical Division of the Bureau of Foreign and Domestic Commerce, totaled 43,772 grams, with an invoice value of $2,276. The imports of reagents and chemicals totaled 76,013 grams, with an invoice value of $690.

Of the total quantity of bacteriological stains imported, 96 per cent came from Germany and 4 per cent came from England. By value, 62 per cent was from Germany and 38 per cent from England. Of the total quantity of reagents and chemicals imported for the six months, 100 per cent—the entire amount—came from Germany.

THE ANTIDUMPING LAW

Abstract of a Talk by John G. Lerch of the Council of the Synthetic Organic Chemical Manufacturers' Association

[EDITOR'S NOTE: *At a recent meeting of the Dyestuffs Section of the Synthetic Organic Chemical Manufacturers' Association, Mr. Lerch, of the association's counsel, spoke on the purposes and construction of the antidumping law, a statute so complex and so ambiguous in many of its provisions that the exact intent of Congress is at places uncertain and the law itself not generally understood. As the term "dumping" has come to be loosely used, some explanation of the law by which it may be restrained should aid in clearing up the misconceptions surrounding its precise meaning. It is with this idea in mind that we are publishing the following memorandum of Mr. Lerch's address.*]

THE purpose of the antidumping law was manifestly to prevent injury to a domestic industry by the importation into the United States of a foreign commodity at an unfair advantage in price.

Usually the liability of the importer to the Government is fixed as of the time he enters his merchandise at the Custom House; but the antidumping law is unique in that it provides, under certain conditions, for following the imported commodity into the commerce of the United States and, if unfair competition results, for the assessment of a compensating duty. The conditions under which this might occur are where an importer technically falls within the definition of "exporter" as given in the law. If an importer is technically an exporter, the "exporter's sales price" as defined by the law is applied to all of his transactions. The provisions of the law make an importer an exporter when the importer is an agent of the shipper, or where either party owns as much as 20 per cent of the voting power or control of the other corporation. It is safe to say that under existing conditions this provision of the law covers the vast majority of imported merchandise. Other provisions of the law cover outright purchases from abroad.

APPLICATION

Whenever a domestic manufacturer feels that imported merchandise is injuring his business, it is his privilege to notify the Secretary of the Treasury of his belief that there may be dumping, stating such facts as may be available to him in support of his contention. The Secretary, upon receipt of this complaint, will call to the attention of the customs officials the suspicion that dumping exists upon this class of merchandise. He will also instigate an investigation through the proper agencies to ascertain the foreign market value, as well as the value for consumption in the United States and all of the other circumstances necessary to a decision on the existence of dumping. Hearings are had at which the importer pre-

sents such data as he may have at hand and the interested domestic manufacturer seeks to show an injury to his trade.

If the alleged injury to a domestic industry is substantiated, the Secretary of the Treasury will issue an anti-dumping proclamation applicable to every customs district in the country. The decision as to whether or not there is an injury to a domestic manufacturer is discretionary with the Secretary of the Treasury.

Merchandise enters the customs under two classifications: (a) by direct purchase and (b) through an exporter's agent.

(a) When entered goods have been *purchased* abroad, the price paid in the country of exportation is compared with the value in that foreign market on the date of purchase. The dumping duty assessed is the difference between these two prices.

(b) Consigned merchandise. On all merchandise *consigned* to an agent it would seem that the exporter's sales price would apply. In the usual course of business, merchandise consigned to an agent is placed in warehouse. When a proclamation of dumping has been issued by the Secretary of the Treasury on such merchandise, if the agent is to avoid the payment of a dumping duty his sales price in the United States must be sufficiently high so that when the duty and cost of transportation are subtracted therefrom the remainder will not go below the foreign market value on the date of exportation. If this figure is less than the foreign market value on the date of exportation, a duty equal to the difference between these two amounts is collected by the Government.

In the enforcement of this provision of the law the agent must give a bond to cover the duties and also to notify the Government within thirty days after the sale of any parcel of the merchandise covered by the dumping order. It will be seen, under this provision, a shipment of a quantity may be entered for warehouse, withdrawals being made daily, and no dumping apply to the sale of the first half of the merchandise. On the other hand, the market in the United States may drop, and the agent when following the domestic market down may subject himself to a dumping duty on the portion remaining in warehouse. From this it will be seen that if the price received for any part of this consignment less the deductions specified by law is less than the foreign market value on the date of exportation, dumping exists.

Illustration

There have been several instances of the application of this law which have demonstrated the effectiveness of this measure. Probably the most drastic of these is the case of the Canadian wheat flour. Several years ago a dumping order was issued by the Secretary of the Treasury on facts which clearly demonstrated to him that dumping existed. The difference between the sales price in the United States, less discounts, and the foreign market value on the date of exportation was so great that to pay this amount, in addition to the regular duties, rendered dealing with the United States impossible. It is said that since the application of dumping to this commodity, no purchaser of wheat flour in this country would buy a single barrel of flour if he could get the same quality of domestic manufacture. This condition has existed for several years, and it is said that the facts which led to the issuance of the order no longer exist, yet the order has not been revoked.

One of the interesting features of this statute is that it contains no provision for revoking the dumping order once it has been issued.

Conclusion

Mr. Lerch expressed the view that while rates of duty have been levied upon imported merchandise which to certain industries would seem to be drastic, yet there has been no levying of duty in any tariff act, unless it be the duties imposed upon coal-tar products, that to any degree afford the same protection as the provisions in the dumping law. This is partially due to the fact that all rates of duty, with the exception of coal-tar products, are based upon foreign market value, and a percentage of a foreign market value is usually but a small portion of the selling price in the United States. The dumping duty, however, is the full amount of the difference between the two values compared.

NEW EDITION OF CUSTOM HOUSE GUIDE

Sixty-four years as a publication marks the 1926 edition of the Custom House Guide, just published. Recognized as the only authoritative and complete information book of its kind, accomplished through an inexhaustible search for and a thorough knowledge of customs and shipping needs, to-day it is found indispensable for the conduct of customs, import and export business and their allied fields.

The United States customs tariff, with all corrections to date, is published in this edition with a special alphabetical index of 20,000 commodities, showing paragraph numbers, rates of duties, Treasury decisions and abstracts, etc., arranged by customs authorities for official use and its publication authorized by the Collector and the Controller of Customs at the Port of New York and the Treasury Department at Washington, a complete and authoritative compilation.

Nineteen twenty-six edition, 1,400 pages, 5 by 7¼ inches, map insert, $5 postpaid, is published and may be obtained from the Custom House Guide, Custom House, New York.

Alexander L. Couper, overseer of dyeing with the Thread Mills in Monticello, Ind., has resigned and has returned east. His successor is M. A. Selisch, of Philadelphia.

AMERICAN DYESTUFF REPORTER

Devoted to the use and application of dyestuffs and the mechanical equipment incidental thereto.

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PROFESSOR OF CHEMISTRY AND DYEING, LOWELL TEXTILE SCHOOL
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MANUFACTURED NEWS

A FEW weeks ago cables from London and Berlin reported that the German dye combine had arranged with the Swiss dyestuff group in Basle to act as sales agents for Swiss dyes in Germany, France, England and America. The news, with minor variations, was published in the trade press here. It was given authority by being circulated simultaneously by the United States Department of Commerce. While seeking some further information The REPORTER was advised by the Sandoz Chemical Works of New York that they had been authorized by their Basle office to state that the Swiss firms have nothing in common with the German I. G. and that there exists absolutely no price arrangement between them.

That, however, is only one example of the kind of rumors that emanate to this country from abroad. Last week it was reported that the Etablissement Kuhlmann, second largest dyestuff firm in France, had increased its capital by ten million francs; the new voting-power shares were to be retained by the Kuhlmann company. Rumors had been current in France that the German I. G. sought to secure control of the French dye company by stock purchases and these additional shares were issued primarily to assure protection against such foreign influence. Swiftly on the heels of this information a dispatch in the New York Times announced that a majority of the Kuhlmann stock had actually been bought up by the German dye trust, "through cleverly concealed stock exchange operations." "French business is greatly agitated over the coup," said the report, "and a special meeting has been called . . . to plan ways and means of regaining control." The disquietude of the French at the discovery that a vital part of their national defense was in the hands of their late enemy, the steady rise of the Kuhlmann stock from 450 francs to 1,000 per share during the past seven weeks, and the proposed method of regaining control by a new issue of stock were some of the interesting details of this story. Three days later a cable from the Paris correspondent of the Daily News Record stated that the Etablissement Kuhlmann had emphatically denied the truth of the whole affair.

The peculiar skill of Germany in the gentle art of propagating false rumors is a war-time tradition. It is highly probable that both the report of the Swiss-German price arrangement and the very interesting account of the Kuhlmann stock deal originated east of the Rhine. From the same source, undoubtedly, came the unconfirmed rumor of four months ago that the Badische company planned to erect a forty-million-dollar plant in the United States; likewise the alarming talk of American dye firms selling out to the I. G. From the same source, most likely, emanated the report of the German-Japanese dye pact and the many other conflicting rumors of foreign pacts that never materialized.

The motives behind these latest rumors are not yet apparent. Perhaps the I. G. is preparing to spring something new. In any case, the press on this side of the water, as well as governmental agencies here and abroad, is not enhancing its reputation for accuracy by swallowing such "scoops" without first tracing their origin and ascertaining their truth.

ADMIRABLE CO-OPERATION

OFFICIALS and chemists of the National Association of Dyers and Cleaners and of the Laundryowners' National Association met recently at the Department of Commerce in Washington to clear up some of the difficulties they experience in cleaning and laundering various textile materials. At the meeting the representatives of both associations decided to assemble specimens of the fabrics that are causing them the most trouble and turn these over to the Textile Division of the Department of Commerce, for distribution to that branch of the textile industry producing them. Thus, samples of silk will go to the silk manufacturers, cotton goods to the cotton manufacturers, etc. Instructions for handling these fabrics will then be requested from the manufacturers. At a general meeting in Washington in September these instructions will be discussed.

It looks as though a load of responsibility for goods damaged in laundries and cleaners is about to be shifted to the shoulders of the textile industry. The numerous complaints and claims caused by the shrinkage, fading and loss of weight of silk in particular are coming home to roost on the doorstep of the silk industry; for, according to the dyers and cleaners, the shrinkage of Georgette and crepe-de-Chine is due to the sizing and other processes of manufacture, and they are proposing a public educational campaign to

protect themselves. This charge takes on greater significance in the light of the increasing demand for washable silks.

It must be admitted that the dyers and cleaners and the laundry owners have put into action with admirable directness their theories about industrial research. By reducing their technical troubles to a common basis, presenting them jointly to the Textile Division, and through that agency to the textile manufacturers of the country, they assure a speedy solution to many of their problems by placing the responsibility where it belongs. Their close co-operation with each other, with the proper governmental bureaus and with the textile industry illustrates what can be accomplished when all factors involved in a situation get together for their common good. And the benefits to every dyeing and cleaning establishment and laundry in the country are obvious. The example is one of the most notable in the annals of trade association activities, and most worthy of emulation.

RECENT IMPROVEMENTS IN MICROSCOPES

Recent British developments in the design and use of the microscope were fully illustrated in the instruments and apparatus exhibited at the Optical Convention held recently at the Imperial College of Science, London.

A microscope has three main elements: the illuminator, the object glass, and the stand which holds the optical parts and object in their proper relative positions. Each of these elements is important, and in all three very notable advances have been made. A series of apochromatic object glasses is now provided which are superior to any made in any foreign country; many of those doing the most exacting work are discarding the foreign lenses in favor of these new ones.

The important British work on filter-passing micro-organisms—"filterable viruses" as they are called—demanded an accuracy of focusing and a rigidity which was not provided by any existing stand, and such a stand has now been evolved in this country.

The improvements in illuminating systems are, if anything, more important even than those in object glasses. A dark-ground illuminator has been developed which permits the use of higher powers than heretofore. Almost immediately this resulted in valuable new knowledge of the structure of the micro-organism associated with a prevalent disease. Other new illuminators for opaque objects, including one peculiarly valuable for metallurgical specimens, have increased the efficiency of the chemical and metallurgical applications of the microscope.

One may mention the entirely novel combined illuminator used in very important recent investigations, in which a high aperture dark-ground illuminator is mounted concentrically with and encircling a quartz condenser. The former secures visibility, and is used to locate the micro-organisms, while the latter is used with ultra-violet light to secure the image on the photographic plate.

ARTIFICIAL DAYLIGHT LAMPS

Some time ago the Berlin correspondent of Industrial and Engineering Chemistry described a new device in the form of daylight spectacles, "Lumina." Experiments in that direction are going further, in order to provide artificial daylight, according to the latest advice from this correspondent. The experiments are of particular interest to the textile industry, paper mills, paint and varnish factories, bleacheries, sugar factories, chemical works and similar industrial units. One of the first daylight lamps was a pure carbon arc lamp by the firm of Korting & Mathieson of Leipzig. Other daylight lamps are the Verico lamps of the Siemens & Halske Akt. Ges., also the lights of the Reinlicht-Industrie Akt. Ges. of Munich, the Tageslicht G. m. b. H. of Berlin, and others. According to Chief Engineer Foerster all these lamps do not yet meet the requirements imposed. But this appears to be the case with the new daylight lamps of the Akt. Ges. fur Elektrizitatsindustrie (Angelindus) of Berlin. This new lamp is based upon the principle of the Geissler tube and the Moore light—i. e., no temperature radiator is involved, but a source of luminescent light alone. This light source emits a pure white light in an Angelindus glow tube filled with carbon dioxide under moderate pressure (about 1/1000 of the atmospheric pressure). The lamp produces a so-called band spectrum as do all incandescent gases and vapors at moderate temperature. In working with aniline dyes in this light differences in color can be detected which are not perceptible in natural daylight. The Angelindus glow tubes filled with noble gases, principally neon, and used for advertising purposes, are based on the same principle.

GERMAN DYE CARTEL BRANCH OPENED IN ENGLAND

I. G. Dyestuffs, Ltd., has been organized in England to act as distributor in Great Britain for the dyestuffs and chemical products, manufactured by the I. G. Farbenindustrie Aktiengesellschaft, Frankfurt-on-the-Main. The new company, which commenced business on July 1 has, according to its prospectus been formed largely with the idea of improving the services which can be rendered to dye users.

The directors are F. E. Craven, A. Edge, A. H George, E. M. de Greeff, W. J. Holland, F. Taylor, A. Singer, Dr. R. Philippi and E. Selck. The registered office is at Cromford Court, Cromford House. Manchester.

The Reduction Products of Azo Dyes

Part XVIII

By WALTER C. HOLMES

Color Laboratory, Bureau of Chemistry

[EDITOR'S NOTE.—*The most practical and effective method for the identification of azo dyes consists in the isolation and identification of the products which they yield on reduction. This method finds less application than it might or should, partly because some of these products have never been isolated and investigated, and partly because much of the data which has been obtained in regard to such reduction products is greatly scattered and very difficult to locate.*

Mr. Holmes has made a search for all the available information on such reduction products, and this series contains a digest of his results with a systematic listing of the reduction products of the azo dyes published in the Colour Index, together with the available data on such properties and reactions as would be of service in their identification.]

No. 218.—3, 3'-DICHLOR-4, 4'-DIAMINO-DIPHENYL
(o, o-dichlor benzidine)

$C_{12}H_{10}Cl_2N_2$; Mol. Wt. 253.08; (C, 56.9%; H, 4.0%; Cl, 28.0%; N, 11.1%).

Derived from C. I. Nos. 434, 435 and 436.

Clear brown needles (alc.), nearly insol. in H_2O. Mpt. 132-3°.

The *hydrochloride*, needles, is sp. sol. in H_2O. Its solutions are colored green by oxidizing agents. The sulfate, nitrate and oxalate are only very sl. sol. in boiling H_2O.

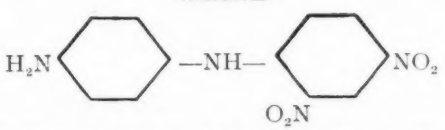
Diazotized and boiled it yields an amorphous red-brown unfusible pdr., insol. in ordinary solvents which gives yellow addition products with HI or with acetic anhydride.

Monoacetyl deriv., white feathery needles, mpt. 104-5°, sp. sol. in H_2O, readily sol. in alc. *Diacetyl deriv.*, white needles (Ac HO), mpt. 302°, insol. in H_2O.

Dibenzoyl deriv., white tufted needles, mpt. 265°.

The 2, 6-naphthalenedisulfonate and 2, 7-naphthalenedisulfonate are sol., respectively, in 1,430 and 1,250 parts H_2O at 15°. Both salts melt above 360°.

No. 219.—2, 4-DINITRO-4'-AMINODIPHENYLAMINE



$C_{12}H_{10}N_4O_4$; Mol. Wt. 274.17; (C, 52.5%; H, 3.7%; N, 20.4%; O, 23.3%).

Derived from C. I. No. 147 by partial reduction.

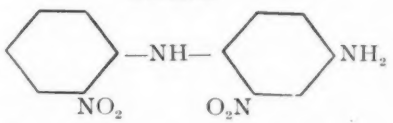
Small brown-red leaflets ($CHCl_3$), mpt. 177°, diffic. sol. in hot alc., more readily in $CHCl_3$ or C_6H_6.

The *hydrochloride* cryst. in yellowish needles, the *picrate* in brown needles, very sp. sol.

The *monoacetyl deriv.* cryst. in ruby-red needles, mpt 238°, the *diacetyl deriv.* in brown-yellow leaflets.

Its salts give violet-blue indamine formation on oxidation and *diaminophenazine* on further oxidation. The latter base cryst. in dark yellow needles, mpt. 280°, and dissolves in H_2SO_4 with a green color turning blue, violet and finally red on dilution.

No. 220.—2, 2'-DINITRO-4-AMINODIPHENYLAMINE



$C_{12}H_{10}N_4O_4$; Mol. Wt. 274.17; (C, 52.5%; H, 3.7%; N, 20.4%; O, 23.3%).

Derived from C. I. No. 146 by incomplete reduction together with the 2, 4', 4-dinitroamino homolog.

Apparently no data are available on these compounds.

No. 221.—4-AMINO-4'-HYDROXYDIPHENYL

$C_{12}H_{11}NO$; Mol. Wt. 185.16; (C, 77.8%; H, 6.0%; N, 7.6%; O, 8.6%).

Derived from C. I. No. 10.

Colorless glittering needles (anisole) or six-sided leaflets (alc.). Mpt. 217.5°. Nearly insol. in H_2O and only slowly sol. in hot organic solvents.

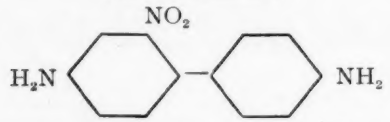
The hydrochloride is sparingly sol. and the sulfate nearly insol. Both cryst. in white sparkling leaflets. The base dissolved in HCl is colored intense yellow by nitrite. A weakly acid sol. of the hydrochloride gives a green-brown color with $FeCl_3$, turning gray-violet on heating and depositing dark flocks.

It gives a diazonium chloride which cryst. with $2H_2O$ in red silky needles and loses its H_2O over H_2SO_4 turning yellow.

It may be converted into 4, 4'-diphenol, mpt. 274-5°.

The *acetamino deriv.*, leaflets or prisms, mpt. 225°, is readily sol. in alc. or in alkalies and nearly insol. in H_2O.

No. 222.—2-NITRO-4, 4'-DIAMINODIPHENYL (Nitro Benzidine)



$C_{12}H_{11}N_3O_2$; Mol. Wt. 229.17; (C, 62.9%; H, 4.8%; N, 18.3%; O, 14.0%).

Derived from C. I. Nos. 431, 432 and 433 by incomplete reduction.

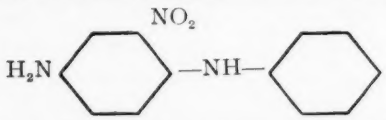
Dark red needles (H_2O), mpt. 143°.

Sulfate ($+\frac{1}{2}H_2O$). Small yellowish cryst., sol. in hot H_2O.

4'-acetyl deriv., yellow plates, mpt. 186-7°, sol. in hot H_2O, alc. and Ac HO.

Diacetyl deriv., small white cryst., mpt. >310°, insol, in H_2O and alc., sp. sol. in Ac HO.

No. 223.—2-NITRO-4-AMINODIPHENYLAMINE

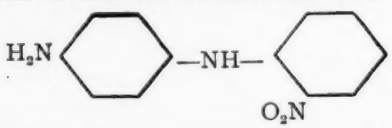


$C_{12}H_{11}N_3O_2$; Mol. Wt. 229.17; (C, 62.9%; H, 4.8%; N, 18.3%; O, 14.0%).

Derived from C. I. No. 145 by partial reduction.

No useful data available.

No. 224.—2-NITRO-4'-AMINODIPHENYLAMINE



$C_{12}H_{11}N_3O_2$; Mol. Wt. 229.17; (C, 62.9%; H, 4.8%; N, 18.3%; O, 14.0%).

Derived from C. I. No. 145 by partial reduction.

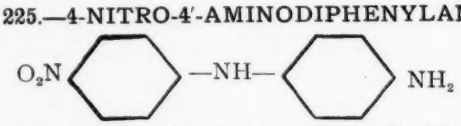
Reddish black spears with green reflex, mpt. 105-6°.

Acetyl deriv., dark red leaflets, mpt. 135-6°.

The *benzylidene deriv.* obtained with benzaldehyde forms dark red cryst., mpt. 98-9°.

Diazotized and coupled (alk.) with ß-naphthol it yields a brick red azo dye which darkens at 130° and melts at 158-60°, and dissolves in H_2SO_4 with a crimson color, turning deep blue on dil.

No. 225.—4-NITRO-4'-AMINODIPHENYLAMINE



$C_{12}H_{11}N_3O_2$; Mol. Wt. 229.17; (C, 62.9%; H, 4.8%; N, 18.3%; O, 14.0%).

Derived from C. I. No. 145 by partial reduction.

Glittering red cryst., mpt. 211-2°.

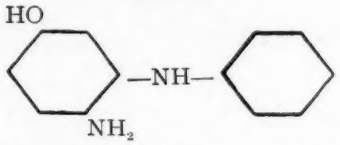
The hydrochloride forms yellow cryst. which soon lose HCl in the air.

The *ethylamino deriv.*, obtained by warming in alc. with ethyl iodide and KOH, forms dark red cryst., mpt. 146-9°.

Acetyl deriv., yellow cryst., mpt. 220°.

The *benzylidene deriv.*, obtained with benzaldehyde, forms golden-yellow needles, mpt. 219°.

No. 226.—2-AMINO-5-HYDROXYDIPHENYLAMINE

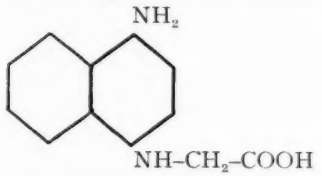


$C_{12}H_{12}N_2O$; Mol. Wt. 200.17; (C, 72.0%; H, 6.0%; N, 14.0%; O, 8.0%).

Derived from C. I. No. 467.

No data available.

No. 227.—4-AMINO-1-NAPHTHYLGLYCINE

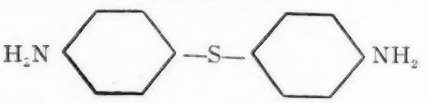


$C_{12}H_{12}N_2O_2$; Mol. Wt. 216.17; (C, 66.6%; H, 5.6%; N, 13.0%; O, 14.8%).

Derived from C. I. Nos. 372, 373 and 437.

No data available.

No. 228.—4, 4'-DIAMINODIPHENYLSULFIDE (Thioaniline)



$C_{12}H_{12}N_2S$; Mol. Wt. 216.23; (C, 66.6%; H, 5.6%; N, 13.0%; S, 14.8%).

Derived from C. I. Nos. 343 and 344.

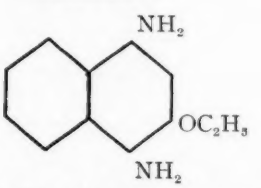
Long thin needles, mpt. 105-8°. Sl. sol. in hot H_2O but nearly insol. in cold H_2O. Readily sol. in alc., ether and benzene.

Hydrochloride ($+2H_2O$), long prisms, readily sol. in H_2O but nearly insol. in org. solvents. *Sulfate* ($+H_2O$), needles or prisms, only sl. sol. in cold H_2O.

Diacetyl deriv., fine needles (alc.), mpt. 214-6°, readily sol. in hot alc., nearly insol. in H_2O.

Thioaniline yields sulfuric and picric acids on warming with nitric acid. With ethyl nitrite it yields phenylsulfide. Warmed with H_2SO_4 it becomes colored blue violet, turning red on dil. Its salts give a violet alc.-sol. pptte. with bichromate.

No. 229.—3-ETHOXY-1, 4-NAPHTHALENEDIAMINE



$C_{12}H_{14}N_2O$; Mol. Wt. 202.19; (C, 71.3%; H, 7.0%; N, 13.9%; O, 7.9%).

Derived from C. I. Nos. 310 and 314.

No data available.

No. 230.—BENZIDINE SULFONE

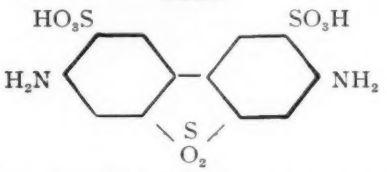
$C_{12}H_{10}N_2O_2S$; Mol. Wt. 246.22; (C, 58.5%; H, 4.1%; N, 11.4%; O, 13.0%; S, 13.0%).

Derived from C. I. No. 437.

Yellow leaflets, mpt. >350°. May not be distilled without decomp. It may be converted into diphenylene sulfone, mpt. 228-30°.

It is insol. in alc. and ether and only very sl. sol. in H_2O. It is weakly basic in character and forms salts with mineral acids which are unstable in H_2O. The hydrochloride cryst. from dil. HCl in soft leaflets.

No. 231.—BENZIDINE SULFONE DISULFONIC ACID



$C_{12}H_{10}N_2O_8S_2$; Mol. Wt. 406.34; (C, 35.5%; H, 2.5%; N, 7.0%; O, 31.5%; S, 23.6%).

Derived from C. I. No. 439.

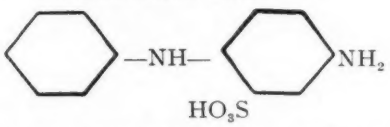
Yellow needles or prisms, mod. sol. in hot H_2O, diffic. sol. in alc., insol. in cold dil. HCl.

Ca salt $(+7H_2O)$, yellow needles or rhombic leaflets, insol. in alc. and diffic. sol. in cold H_2O.

Ba salt $(+4\frac{1}{2}H_2O)$, small needles, diffi. sol. in hot H_2O.

On oxidation with warm alk. $K_3Fe(CN)_6$ the acid yields a brown-red azoxy dye which dyes wool cochineal-red. The absorption maximum of aqueous solutions of the dye is 574 mu.

No. 232.—4-AMINODIPHENYLAMINE-2-SULFONIC ACID



$C_{12}H_{12}N_2O_3$; Mol. Wt. 264.23; (C, 54.5%; H, 4.6%; N, 10.6%; O, 18.2%; S, 12.1%).

Derived from C. I. Nos. 304 and 305.

Dark leaflets which dissolve in H_2O readily yielding unstable sols. which soon darken in air.

With $FeCl_3$ the sols. turn red and then violet and yield a dark pptte. Bleaching powder in acid (HCl) sol. gives a blue color which gradually turns green and then violet.

Ba salt $(+H_2O)$, silvery gray leaflets which darken on exposure to air.

Anilide, glittering leaflets (alc.), mpt. 171°.

James Richardson has taken charge of the dyeing department at the Franklin, N. H., mills of the Sulloway Company. He was formerly in charge of the dyeing for the Amoskeag Company, at Manchester, N. H.

DYE COST STUDY NEARLY COMPLETED

The investigation of the cost of dyes in specific fabrics and garments, undertaken some months ago by the United States Tariff Commission, is nearly completed. The finished report, it is expected, will be published in September as part of the annual Census of Dyes and Other Coal-Tar Products.

The data compiled by the commission in an effort to arrive at the average cost of dyes in various kinds of fabrics and wearing apparel were obtained only after considerable research among dye manufacturers and importers, textile manufacturers, producers of men's and women's apparel, and dyers and finishers. The information gathered from these sources was analyzed and supplemented by replies to a questionnaire mailed to a number of business men. It will be the first comprehensive study ever undertaken by a governmental agency for the purpose of determining, on the basis of the retail unit of piece goods and garments, the cost of the dyes used in fabrics.

The work of the commission was carried out under the direction of Dr. W. N. Watson, color specialist of the chemical division, who also has charge of the census of dye manufactures, which has become an annual feature of the commission's work and is regarded by the industry as of the greatest value.

The study of dyes in textiles, when completed, will present a summary giving average cost of dyes as they appear in a suit or overcoat or in a drass or wrap and in a yard of piece goods, together with statistics giving the maximum and minimum range of costs with the use of dyes of different qualities producing the same approximate shade. It embraces studies of identical dyes in materials of different fibers and different construction. Altogether, it is said that this study will present facts of deep significance to the textile and dye industries heretofore not disclosed in any statistical study.

CUSTOMS APPEAL CASE AIMED AT FLEXIBLE TARIFF

What is termed by some as a direct attack on the constitutionality of the flexible provisions of the present tariff law will be opened in a case before the United States Court of Customs Appeals, set tentatively for October 6. The case which involves the issues aimed at the tariff was brought by J. W. Hampton, Jr., & Co., of New York City, an importer of barium dioxide, the duty on which was raised from 4 to 6 cents by executive order under the flexible provisions.

At hearings before the United States Customs Court, formerly known as the Board of General Appraisers, the validity of the flexible tariff law was affirmed, but with one dissenting opinion by Judge George Stewart Brown. An appeal was then carried to the United States Court of Customs Appeal.

Technical Notes from Foreign Sources

Scouring Losses in Working Up Cotton

Using an experimental kier which was found to reproduce technical conditions satisfactorily, a study has been made of the caustic boil under the extreme range of conditions represented by normal works practice. Typical American, Egyptian and Indian yarns were tested, and the factors determined were scouring loss, residual wax content and final Methylene Blue absorption and copper numbers.

Various modifications of the water, soda and lime boils have also been tested on the same yarns. The results are interpreted as indicating the relative efficiencies of pressure, alkali concentration, lime, etc., in scouring and of Methylene Blue absorption and copper numbers as control tests. In addition, scouring losses during the normal pressure boil with sodium hydroxide have been determined for a wide range of cottons, the literature on this subject containing so many contradictions.

The losses ranged from 6 to 9 per cent, American varieties coming at the lower limit, Egyptian intermediate and Indian high. Only one cotton was found outside this range—namely, Pima, with a loss of 11.5 per cent—but this variety is abnormal in other respects.

About half of the material loss cannot be accounted for as wax, nitrogenous material, mineral matter, or other substances removable by cold water or cold dilute acids. The above losses in the normal caustic soda boil do not represent all the material in cotton, which is less resistant than "normal" cellulose to caustic alkali. A further loss of 1 to 2 per cent occurs if 3 per cent of sodium hydroxide is employed at an excess pressure of 40 pounds instead of 1 per cent at a pressure of 20 pounds.

(For further details see Journal of the Textile Institute, 1926, Vol. 17, pages 233-246T.)

Ripening of Viscose Solutions

The number of thiocarbonate groups combined with cellulose may be determined by titration with iodine. The xanthate content diminishes regularly, the velocity increasing with the rise of temperature. All carbon disulphide combined with cellulose reacts with iodine. The sensitiveness of a viscose solution to electrolytes depends on the molecular complexity of the cellulose, the number of xanthate groups combined with cellulose, the amount of electrolytes which are always present in viscose solutions, the amount of free sodium hydroxide, and the temperature.

In the determination of ammonium chloride ripeness the sodium hydroxide content is important, and the appearance of spontaneous coagulation is not sharply defined. Loss of carbon disulphite molecules does not necessarily imply a diminution in the size of the molecule. In following changes of viscosity the sodium hydroxide content must be the same as that of technical viscose solutions. Viscosity and ammonium chloride ripeness give comparable figures for the condition of viscose solutions.

Fresh viscose solution, after mixing with ammonium chloride, generally contains free caustic soda, the amount of which increases the older the solution. At the coagulation point perfectly fresh viscose solution, containing little alkali, has an excess not of free alkali but of ammonium chloride. With increasing alkali content of the viscose solution the amount of ammonium chloride used in double decomposition is so great that the cellulose complex is precipitated in a solution which still contains alkali.

The stability of viscose solutions toward congelation increases with increasing xanthate content, and this effect is greater than the influence of sodium hydroxide, especially in fresh solutions. Solutions rich in sodium hydroxide and containing the same amount of xanthate have an apparently smaller ammonium chloride ripeness. In very ripe solutions, which almost coagulate spontaneously, the effect of the xanthate content on the ammonium chloride ripeness almost disappears. The number of xanthate groups found by titration with iodine increases with the amount of carbon disulphide used. (Kunstseide, 1926, Vol. 8, pages 17-19, 43-46 57-59.)

Bleaching of Wool with Hydrogen Peroxide

A determination of the factors which are responsible for the loss of weight and damage to the epithelial scales of ordinary and moderately chlorinated wool fabric during bleaching at a temperature of 55 deg. Cent. by means of solutions of sodium peroxide having a known pH of 9 to 13. The bleaching solutions were prepared by the addition of sodium silicate to hydrogen peroxide. Bleaching causes no marked increase in the proportion of damaged fibers of ordinary wool, but a distinct increase in chlorinated wool, especially when the bleaching liquor has a pH exceeding 10, the increase being proportional to the pH.

The loss of weight produced by bleaching increases with increase of pH, and is much greater for chlorinated than for ordinary wool. A better white is obtained in the more alkaline bleaching liquors, and the best color, together with the least structural damage to fibers, is obtained with pH 10. A mixed indicator containing dinitrodiazoaminobenzene and phenol-

phthalein or phenolthymolphthalein is suitable for controlling the acidity of bleaching liquors. For example, an indicator containing 5 c.c. of a saturated alcoholic solution of dinitrodiazzoaminobenzene and 0.1 c.c. of a 0.4 per cent alcoholic solution of phenolphthalein gives a range of colors: pH 8, yellow; pH 9, reddish yellow; pH 9.5, redder yellow; pH 10, orange; pH 11, red, and pH 12, deeper red.

(For further details see the original article in the Journal of the Society of Dyers and Colorists, 1926, Vol. 42, pages 154-157.)

Dyeing Brown Shades on Cotton Fibers

Cotton is dyed in brown shades fast to washing, alkali, chlorine and light by impregnation with a solution that contains products that are obtained by the condensation of formaldehyde and aniline or its homologues in acid solution, being afterward passed through a solution of sodium hydroxide or sodium carbonate, then washed, oxidized with a dilute solution of sulphuric acid containing a dichromate or persulphate, washed and soaped. The resulting shades may also be diazotized and developed wtih beta-naphthol or coupled with diazo compounds.

Alternately cotton is impregnated with a solution containing lactic acid, the above-described condensation products, sodium chlorate, sodium acetate and copper sulphate or a vanadium salt, then oxidized for a period of six hours at a temperature of 40 deg. Cent. with a solution of dichromate. While and colored resists may be obtained by after-printing with a reducing agent—for example, a sulphite, bisulphite or hyposulphite—and suitable coloring matters.

Brown effects are also obtained by printing cotton fabrics with a paste which contains the condensation products and gum tragacanth thickening drying, fixing in an alkaline solution, and developing the shade by oxidation with a persulphate. Alizarine and vat coloring matters may be printed and developed simultaneously by oxidation. (French Patent No. 595,705.)

Bleaching Linen Yarn

The bleaching of linen yarn varies in accordance with the quality of the yarn, which means that the bleaching process is as varied as the quality of the yarn itself. It is therefore up to the operator to choose the correct process in order to obtain the proper results.

As a general rule, linen yarn is bleached on the reel. This consists of a large container made of concrete and provided with a number of rollers which can be driven by power but which can be separately removed. In this process the yarn is previously boiled out in a kier under a pressure of half to one atmosphere for a period of six to seven hours, and then well washed in the same kier and pressed between squeeze rollers.

The skeins are then hung on the rollers in the bleaching apparatus and are spread out on a felt band. Then the previously prepared bleaching liquor or chloride of lime solution is allowed to flow into the apparatus and over the goods until the desired effect is obtained. When the bleaching is finished, the rest of the liquor is pumped out of the apparatus, and the linen, while still in the same bleacher, is washed with water.

In general, the washing consists of three separate fresh-water washes and the yarn is then introduced into a second apparatus for souring. This apparatus likewise consists of a concrete container in which a tightly fitting wooden box is inserted. The souring lasts, as a general rule, for one to one and one-half hours, and then the acid is removed. When the acid liquor has not been entirely exhausted, it can be pumped back into a storage tank and used again for other treatment. After the yarn is repeatedly washed it is soaped and then blued.

Linen yarn can be bleached, just like cotton yarn, in a kier with internal cooking and without unpacking the yarn. Just as in the case of cotton yarn, so in the case of linen yarn, it is essential that the yarn is uniformly packed into the kier. This is best done by laying the yarns obliquely across the bottom of the kier and winding the yarn also around the central heating tube, placing one layer across the other and ending the last layer about 10 cm. from the top edge of the kier.

The materials are well covered, and then liquor is allowed to flow into the kier, the cover is bolted down and the yarn is boiled for six to seven hours. The remainder of the operations—that is, washing, chlorinating, washing, souring, washing and soaping—are carried out in the same manner as in cotton yarn bleaching.

The linen yarn always has dead-looking threads after bleaching and drying, being in this respect no different than cotton. It is therefore advisable in the case of warp yarns to add some potato starch paste to the soaping and bluing baths. The liquor is warmed up to a temperature of approximately 45 to 50 deg.. Cent. and the yarn is allowed to remain half an hour in this liquor. Thereafter it is centrifuged and stretched. When it is desired to have the threads still smoother in appearance, the proportion of starch paste used is increased.

It has been found that glycerine, paraffine and tallow are best suited for smoothing out warp yarns. The yarn is treated in a mechanical brushing machine. (Deutsche Faerber Zeitung, 1926, page 653.)

DEPARTMENT OF PUBLIC INFORMATION

The United States Testing Company, Inc., has established a Department of Public Information, which is to furnish a direct means of communication between the public and the work of the Testing House. The department will be in charge of E. L. Hodge, formerly associate editor of Silk.

Practical Hints on the Production of Bright Colors on Textile Fabrics

Part XXIV

Surface Spray Topping—Construction of the Plant— Its Operation and Advantages

By RAFFAELE SANSONE

THERE are cases in which, for economy's sake or for producing special classes of goods, it is desired to top only the surface of the material with solutions of basic colors, leaving the interior untreated or slightly treated. For the purpose the plant shown in Fig. 1 can be employed to advantage when it is necessary to spray-top the cotton fabric only on one side or where, in conducting a two-side topping, it is not intended to conduct a double passage.

Here is to be seen a plant adapted for superficially spray-topping the cotton cloth, which has been dyed in the direct colors, only on one side, and where the necessary arrangements have been made to avoid the coloring of the back of the fabric and to recover the volatile solvent used.

The plant contains a large hot flue or oven constructed on the same principle as many of the machines employed for the drying of printed goods, and composed of a high, broad iron case supplied with large doors, allowing the entrance of the operatives for the spreading and cleaning operations, and with large glass windows, allowing easy observation of the interior, for controlling the manner in which the cloth is passing through and if plaits have been formed which should be eliminated.

The interior of the case contains several series of guide-rollers (a, b, a, b, a, b, a, b, a, b) placed in such a manner that the cloth entered for the drying operations encounters after a time the portions that have preceded it and have been dried; without, however, touching them in any way. For the purpose the cloth to be topped is entered from a wooden beam (A) by a small guide-roller (e), and mounts after passing before the sprayer tube i to the first of the rollers a, continuing after this always on rollers a, a, a, a, a, a until reaching the central roller O. After this it makes its way out, repassing on more or less the same road; coming, however, on rollers b, b, b, b, b, b, and finally descending on guide-roller f and winding on the wooden beam B.

The lower portion of the iron case contains a large steam radiator, through which the temperature of the interior of the oven can be raised to any desired degree above 50 deg. Cent., while on its cover is a special ventilator (V), driven by shaft H and a small electric motor not connected with the driving motion of the plant.

Ventilator V has at the top the tube L leading to the copper coil S, in which all aspired solvent is reduced to liquid form and delivered to a collection bottle F held on a long narrow shelf of sufficient length to contain several of such bottles. To these bottles the operatives have easy access from the upper landing X, and can mount on the top of the oven from this landing by an iron stairs. Coil S is cooled in an iron cylinder, where water is entered continuously by tap g, making its exit from above by tube h. The temperature of the water issuing from tube h can be controlled by a suitably placed thermometer.

In order to observe the spraying being conducted in the interior of the oven, just before the sprayer i is placed the plate-glass window G, whereas for collecting any spraying bath that goes beyond the borders of the fabrics, just behind the spot where the fabrics pass is placed the copper collection plate C, the lower portion of which terminates in a small trough having a tube leading to the lower cement trough E. A small pump is supplied for delivering the bath collected here from time to time to the distribution troughs T or U.

Sprayer (i) is furnished with the necessary topping bath, dissolved in the volatile solvent (a suitable commercial alcohol) through tube t. This last can be rapidly fitted by a junction ring (o) to the bottom of a tap (m) fitted to the spraying liquor trough (T). This is of special construction, of cylindrical shape, and the bottom slopes, terminating in tap m, while its upper portion is supplied with a supporting chain (r) joined to a ring, through which the trough can be raised by a crane (c) running on the overhead rail R.

The plant has a supplementary trough U, also supplied with a lower tap (n) and juncture ring (p), which can be raised by chain s and the crane d, also running on the upper rail R. At one side of both troughs (T and U) is placed a long narrow glass window, through which the operatives can observe the height of bath in each of the troughs from below. Troughs T and U are also supplied with a cover having a small tap.

For driving the rollers a, b, a, b, a, b, a, b, e and f in the interior of the oven and the wooden beam B on

which the dried topped cotton cloth goods are wound, the plant is supplied with a large electric motor with a variable speed arrangement.

Rail R leads to the department of the well where the dyeing of the cotton cloth is performed with the direct colors, and to where the colored topping baths are prepared. It is of special construction. Toward the oven it forms a loop on which any of the troughs with the topping bath can be carried through the chain of the crane to another rail at the back, placed in a slightly slanting position which delivers it little by little to other parts of the dyehouse and into the department of preparation without requiring extra labor. Here another loop brings it back to rail R, which, being also placed in a slanting position, can carry it back to the oven. The rolls of cotton cloth to be entered in the plant for the topping operations are carried before the oven on a low wooden truck running on wheels and easily pushed by one of the operatives or electrically driven.

Operation of the Plant

The operation of this dyeing plant requires some skill, and therefore practice, before it can be carried out to the best advantage. A way of working a large lot of cloth would be as follows: The operatives open all doors and windows in the oven, entering a pair of long narrow cotton or hemp tapes and causing these to pass first around roller e, then in side grooves on all guide-rollers a, a, a, a, a, a, until reaching the central roller O, then in side grooves on all guide-rollers b, b, b, b, b, and finally out of the plant through the lower roller f.

When the above operation has been accomplished, the operators sew to the end of the two tapes the beginning of the first roll of cloth to be topped (A), pulling the tapes until the cloth has been straightened. The volume of the coloring solutions necessary for the topping operations is now prepared in troughs T and U, by placing these in separate hot-water baths kept continually at the boil and stirring in them a fixed volume of methylated alcohol with the required weight of the coloring matter, which can be a Safranine, a Rhodamine, an Auramine, a Methyl Violet, a Methylene Blue, a Bismarck Brown or a Spirit Red C, a Spirit Orange, a Spirit Yellow, a Spirit Brown and similar colors.

The solution of the basic or other dyestuff is assisted

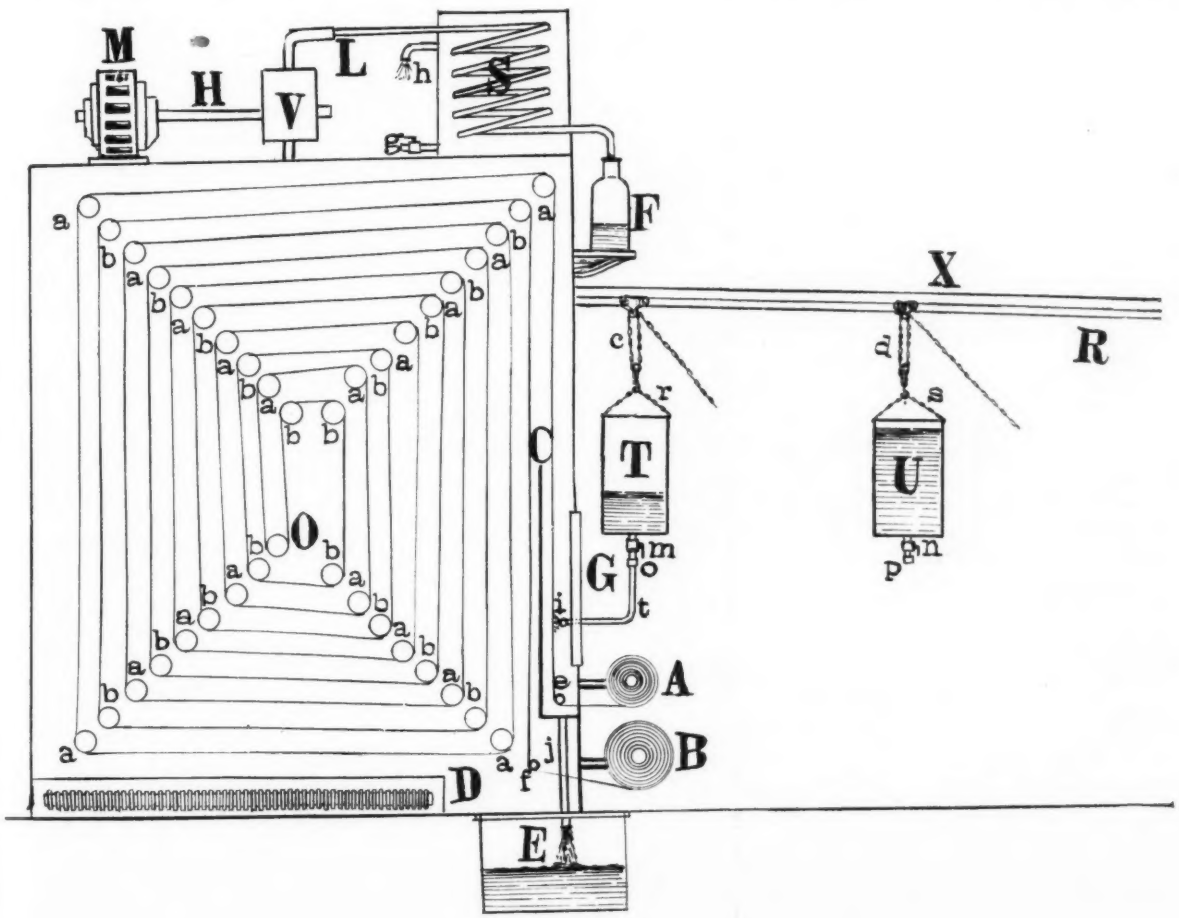


Fig. 1

by agitating the two baths with wooden sticks, after which the troughs are closed, the taps above being left open and carried to the topping plant, where the first trough is joined to tube o through the screw ring juncture already indicated. When this has been accomplished, the methylated alcohol solution is allowed to cool to the temperature of the atmosphere of the chamber of treatment.

The operatives start motor M at the top of the oven, to run through shaft H, ventilator V, and send a stream of air through coil S, running in soon after the supply of cold water through tap g, which makes its exit later by tube h, and turning on steam in radiator D to start the warming operations. At this point the operatives open tap m and start the plant, collecting the different lengths of cotton or hemp tapes as they issue on a sort of double bobbin ready for later employment, unsewing them rapidly from the end of the topped piece as this comes out and is wound on the wooden beam B.

As the dyed cotton cloth enters the oven, it exposes continually its front or rear portion to the action of the topping spray and is evenly covered over with a very thin layer, fixed superficially by the direct colors of the ground; which, however, still show through to a certain extent, producing a change that is apparent when compared with the untreated face of the fabric.

As the wetted surface makes its way upward on rollers a, a, a, a, a, a, passing repeatedly around the oven in the hot air produced which mounts continually, the volatile solvent is rapidly evaporated, mounting in ventilator V and passing in contact with the cold sides of coil S. Through a similar arrangement the original alcohol employed for the solution operations is regenerated in its liquid form and collects in flasks F ready for further employment.

By the time the fabric reaches the middle of the oven and passes on roller O, its topped surface is thoroughly dry and can be brought into contact with the rollers indicated by b, b, b, b, b, b, without suffering any smudging or without coloring the latter in any way, so that the further drying that takes place after this only really serves to expel the greater portion of the gaseous alcohol still clinging to the material.

As one roll is nearing the end on beam A, another is rapidly introduced in its place, after sewing the beginning to the end of the last piece, until the whole batch of cloth to be topped has entered; taking the precaution, however, to sew on in time the two tapes originally employed at the end of the last piece of the lot of cotton cloth to avoid extra work in following topping operations.

When the contents of one trough have been consumed, those of the second trough are utilized, the plant being stopped for a moment, just the time necessary to disconnect and carry forward the empty trough on the loop to the back rail, where it travels on its own account to the department for the preparation of another color bath, and fixing on the filled trough in its place, the tap of which is then opened for exactly the same amount as in the first case. If everything has been properly calculated, the contents of this second trough should be sufficient to complete the treatment of the whole batch with little waste of coloring matter solution, which can be consumed nearly to the last drop. Cases may arise, however, where the use of a third and fourth charge of dyeing fluid may be necessary, especially if the spraying has to be of some intensity and the batch to be topped is very large.

The topped cloth making its exit from the oven is distributed over several wooden beams, and the rolls formed are collected on a second wooden truck, driving this at the end of the topping operations into the finishing room, for passing to a stenter or tentering frame, where the material is straightened before passing between the bowls of the calenders.

When all the topped cloth has made its way out of the oven and half a yard of the two cotton or hemp tapes has passed out, the plant is stopped, opening, after a time, all windows and doors in the oven to cause the cotton tape to fall in all grooves on the guide-rollers a, a, a, a, a and b, b, b, b, b, ready for the next treatment.

Advantages of the Plant

The above plant possesses several marked advantages which are well worth considering. Some of them are as follows:

1. The intensity of the spraying color can be varied to suit the velocity at which the cotton cloth goods are run through the oven, or to cause a stronger or weaker penetration.

2. Only just sufficient topping bath required for the yardage of cloth to be treated can be prepared.

3. The volatile solvent being alcohol, the cost of the basic color solutions employed for the spray topping operations is much below what it would be if benzine or other similar solvent was employed; being also less dangerous, owing to the higher boiling point of the alcohol.

4. The greater part of the alcohol is recovered during the topping and drying operations, and can be employed several times.

5. If the department in which the plant is placed is well ventilated, the limited quantities of alcohol vapor that escape into the treating department, despite the precautions adopted, exert no intoxicating action on the operatives.

6. All topping cloth not touching the cloth falls into cistern E, and through the small pump annexed to the same can be re-employed during the running of the plant in trough T or U.

7. The operatives can observe the spraying action exerted by tube i, although this is conducted in the oven itself.

8. The interior of the oven can be observed from without at any time to note how the material is being dried.

9. The producion is large, with economy of coloring bath, time, space, motive power and labor.

10. When no topping operations are being conducted, the oven can give valuable service for drying purposes.

(Part XXV will appear in an early issue)

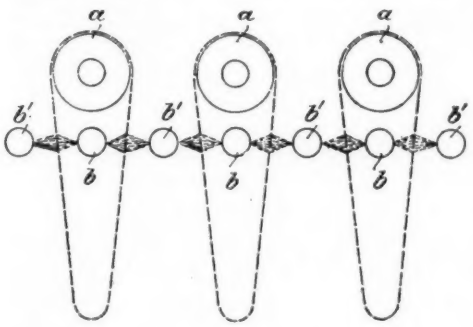
RECENT PATENTS

Method of Dyeing Hanks

(1,586,377; May 25, 1926)

Paul Missy, Krefeld, Germany.

Method of dyeing hanks of yarn comprising suspension



of the hanks from rotating rollers and spraying hanging parts of the hanks by opposed jets substantially as set forth.

Bluish-Green Dyestuffs and Color Lakes Therefrom, and Process of Making Same

(1,587,435; June 1, 1926)

Otto Staehlin, Hochst-on-the-Main, Germany, assignor by mesne assignments, to Grasselli Dyestuff Corporation, New York, N. Y.

Process of producing bluish green dyestuffs which comprises treating a halogenated 1, 5-naphthylenediamine sulphonic acid with a soluble ferric salt.

Process for Manufacturing Vat Dyes

(1,586,730; June 1, 1926)

Alois Zinke and Franz Hanselmayer, Graz, Austria, assignors, by mesne assignments, to Felice Bensa, Genova, Italy.

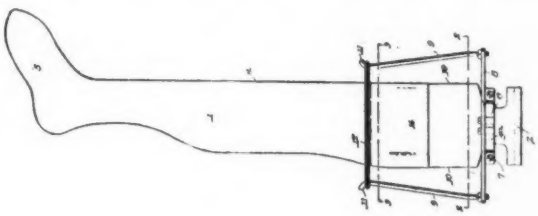
A process for manufacturing a vat dye consisting in heating the dibenzoate of dihydroxyperylene with anhydrous aluminium chloride to a temperature of 160 deg. to 200 deg. centigrade and purifying the product.

Hosiery Drying and Finishing Structure

(1,586,329; May 25, 1926)

Edison E. Randall, Kankakee, Ill., assignor to Pope Machine Company, Chicago, Ill.

A hosiery-holder structure including upstanding spaced posts, an annular hosiery-engaging element extending be-



tween the posts and circumferentially expansible thereon, and a hosiery drying and shaping member upstanding between the posts and encompassed by said element to counteract the tendency of a hosiery-article to slip thereon.

Treatment of Cotton Fabrics

(1,587,094; June 1, 1926)

Ernest D. Walen, Melrose, Mass., assignor of one-fifth to Walter S. Burrill, one-fifth to Albert F. Knight, and one-fifth to William T. Mayo, all of Hamilton, Ontario, also one-fifth to Russell Hathaway, Braintree, Mass.

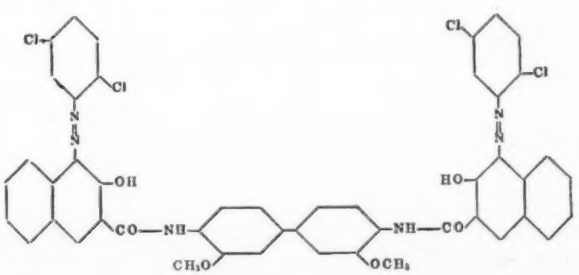
A fabric for use in a paper-making machine the fibers of which are coated with an alkali silicate and are impregnated with moisture comprising a soluble oil.

Azo Dyestuffs and Process of Making Same

(1,587,060; June 1, 1926)

Arthur Zitscher, Offenbach-on-the-Main, Germany, assignor to the Corporation of Chemische Fabrik Griesheim-Elektron, Frankfort-on-the-Main, Germany.

As a new article the azo dyestuff, having probably the formula:



CONSOLIDATION OF GERMAN DYE SALES AGENCIES IN MEXICO

A new corporation under the name of Cia. General de Anilinas, with offices in Mexico City, has been formed by a combination of the Mexican sales organizations of the German dye cartel. General industrial chemicals will be handled by the Fabricas Unidas, formerly exclusive representative of the Afga Company, and Westcott y Cia., which has been representing Bayer, will carry all stocks of German pharmaceutical preparations.

NEWPORT PRODUCES NEW BLUE BLACK

A leaflet distributed by the Newport Chemical Works, Inc., describes the properties and features of Newport Anthraquinone Blue Black B, said to be of value for dyeing wool in every stage of manufacture, either by the after-chrome, chromate or bottom-chrome method, in all types of machines. This color, it is further claimed, is of excellent fastness to light, perspiration, fulling, steaming, carbonizing, salt water, etc., as well as level dyeing. It is thus useful as a shading color for chrome and alizarine dyestuffs. The leaflet exhibits the shade on swatches of wool in three percentages and gives the method of application.

NEW WESTERN REPRESENTATIVE

The United Chemical Products Corporation of Jersey City, manufacturers of dyestuffs and chemicals, is now represented in Chicago and the Middle West by A. Jameson, who recently joined their organization. Mills in the territory covered by Mr. Jameson will thus have the advantages of his personal service in placing their orders for dyestuffs and chemicals.

NEW DU PONT BROWN AND GREEN

Two products recently developed by the dyestuffs department of E. I. du Pont de Nemours & Co. have been placed on the market under the names of Du Pont Chromate Brown EB and Sulfogene Fast Green B.

Du Pont Chromate Brown EB, a product described as chemically similar to Anthracene Chromate Brown EB, is said to be particularly useful for dyeing mode and combination shades on woolen yarns, slubbing and wool piece goods, due to its neutral shade and good fastness to light and fulling. It is best dyed by the chromate method.

The new Sulfogene Green, according to the announcement, is of very bright bluish tone which changes very little on after-treatment. It is stated to be especially desirable on account of its extreme brilliance of shade and excellent fastness properties, and is described as particularly fast to light, acids, alkalies and cross-dyeing. Its solubility makes it suitable for all types of circulating machines. It is said to be similar in shade, strength and properties to Cross-Dye Green B.

FOREIGN CHEMISTS HERE FOR JUBILEE

The golden jubilee of the American Chemical Societry is drawing to this country a large contingent of noted foreign chemists who will participate in celebrating the anniversary of the society in Philadelphia on September 6. A number of prominent German, French, Swiss and English chemists have already arrived.

The society has elected to honorary membership fourteen noted chemists, representing the United States, England, Holland, Scotland, Italy, Switzerland, Japan, Czecho-Slovakia and Belgium.

HAND-PAINTED TEXTILES IN VOGUE

Silks, woolens and millinery hand-painted in large cubist designs represent the latest mode of decorating fabrics, a style which has gained considerable prevalence among Parisian textile manufacturers. The designs are being applied with equal success to dress goods of silk and hats of felt and other material, the colors used being mainly soft tones, though often painted on fabrics of brilliant shades. The colors are put on with lacquer paint.

The rate for "Position Wanted" advertisements in this column is 2 cents a word—with a minimum of 50 cents per insertion. For all other types of advertisements—i. e., help wanted, machinery or supplies for sale—the rate is $5.00 per column inch or less per insertion.

SITUATION WANTED

Worsted dyer, 26 years of age, desires position. Graduate of Textile School and five years of mill experience; also laboratory experience. Excellent references gladly given. Address Box 347, American Dyestuff Reporter.

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Chemist, thirty-five years of age, fifteen years' dyestuff experience, two years' experience boss dyer and chemist in cotton piece goods, desires permanent connection. Thoroughly competent colorist on all types of dyestuffs on cotton and some experience on silk mixtures. Box 348, American Dyestuff Reporter.

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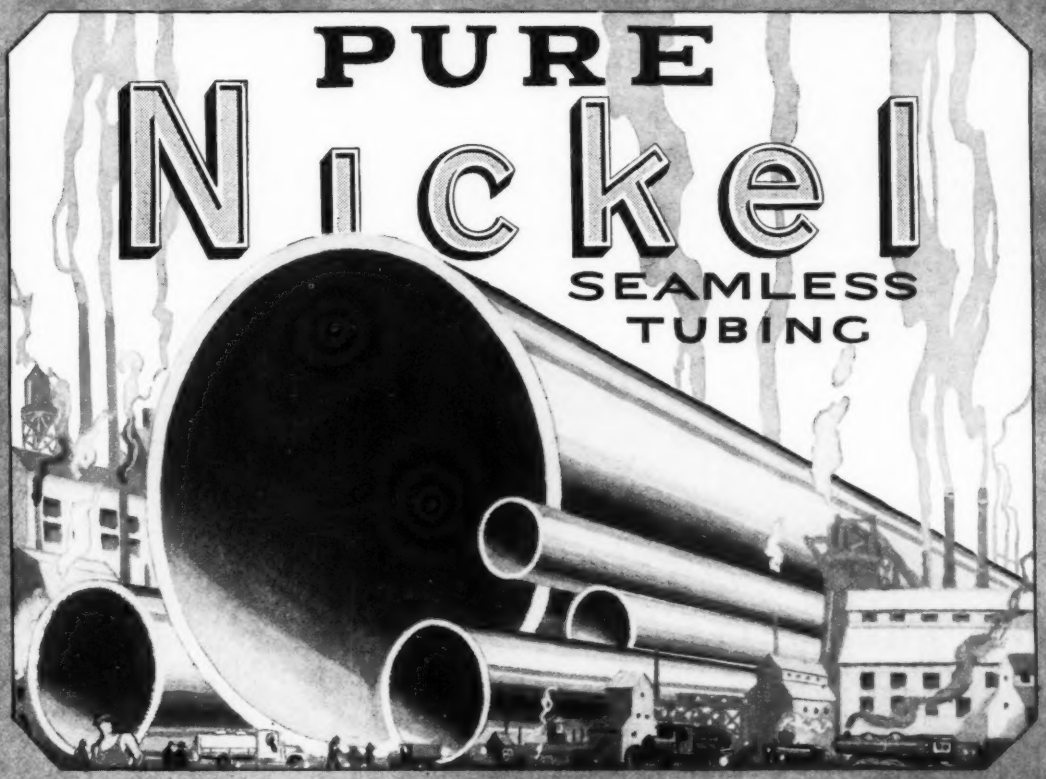

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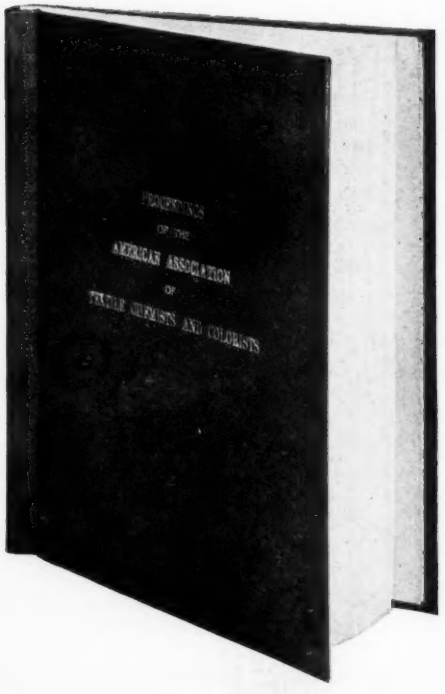

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COLOUR INDEX

in the English Language

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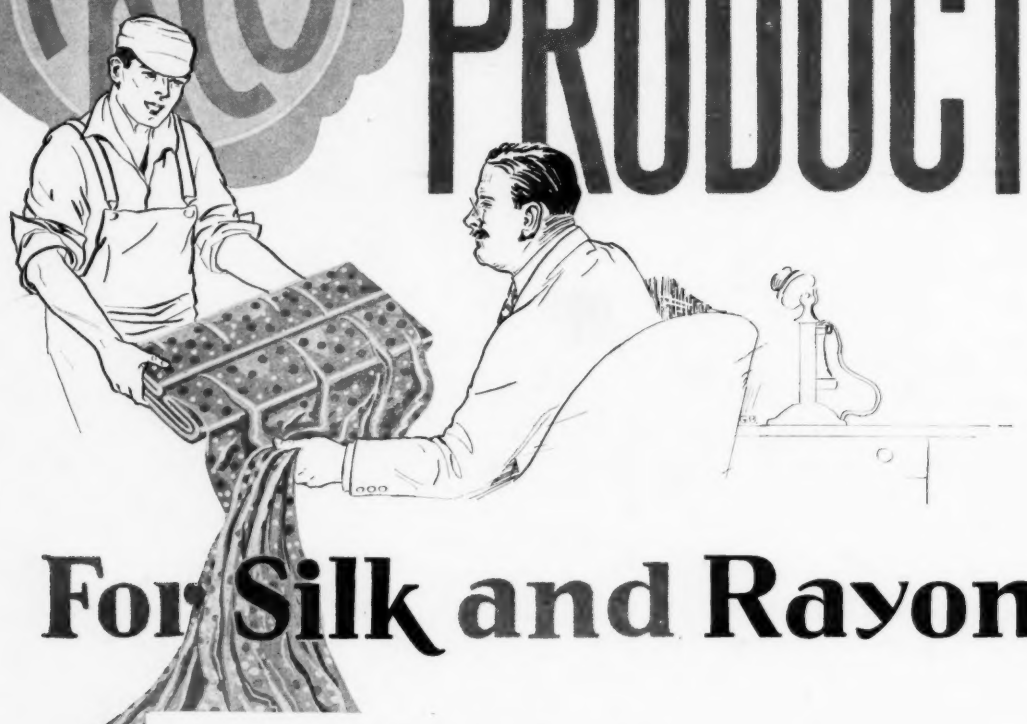

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